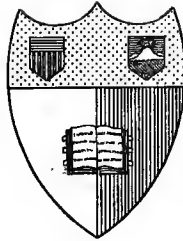


THE FEELINGS OF MAN

N.A.HARVEY



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THE FEELINGS OF MAN

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Their Nature, Function and Interpretation

By

NATHAN A. HARVEY

State Normal College, Ypsilanti, Michigan



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PREFACE.

The New Psychology is distinguished from the Old especially by the greater emphasis it is inclined to lay upon physiological processes. The past twenty or thirty years have seen greater progress in the development of psychology than has been made before since 1691, when Locke's *Essay on the Human Understanding* was published. This progress has been accomplished largely by the study of physiological changes as they are associated with psychological processes. But the physiology is still physiology, and the psychology is still psychology, and no thorough amalgamation of the two series of processes has yet been successfully accomplished.

In the present book an attempt is made to bring about a closer union of the two series of phenomena than is ordinarily undertaken. The doctrine of parallelism, or correspondence, is invoked to furnish a tentative justification for an interpretation of mental processes in physiological terms.

It must be recognized that the doctrine of parallelism asserts no finality, but represents rather an armistice between two hostile philosophical camps. Psychology can well afford to assume this position which the doctrine of parallelism represents, for it professedly deals with phenomena, and not with ultimate finalities.

The plan of the book demands the postulation of a physiological hypothesis, which is incapable of direct verification, but which is demanded to explain the relation of directly observed phenomena to each other. Such an hypothesis is of the same nature for psychology as

the atomic theory or the electron theory is for chemistry, and has the same value for psychology that the representation of forces by lines has for physics. In no other way does it seem possible to bring the full effect of the studies in physiology for the past twenty-five years to the interpretation of psychological phenomena.

Psychology may be written without reference to physiological processes, just as physics and chemistry may be studied without referring to atoms or electrons or the parallelogram of forces; but so helpful are the connotations of these physical hypotheses that nearly all teachers use them. We shall find equal or greater value arising from the employment of a physiological hypothesis in psychology.

In developing a hypothesis of this nature, it will readily be recognized that much modification of the simple hypothesis may be necessary in order to make it accurate throughout, and applicable to every case, or capable of explaining all observed phenomena. As complex as our hypothesis may seem, it is probable that the physiological changes that occur are many times as complex as the statement of the simple hypothesis will indicate.

As there is no method of demonstrating the hypothesis by direct observation of the physiological changes, its truth or falsity must be judged by its ability to explain all the observed phenomena. In so far as we are able to explain by the hypothesis all observable phenomena, we may accept it as true. Certainly such an hypothesis is within the bounds of possibility, and we are by its means able to bring the results of physiological investigations to the proper understanding of phenomena universally recognized as psychical.

NATHAN A. HARVEY.

Ypsilanti, Michigan, October 8, 1913.

THE FEELINGS OF MAN

Their Nature, Function and Interpretation

CHAPTER I.

MEANING OF THE TERMS.

The word feeling is used in various ways to signify many different things. It has a well recognized meaning nearly synonymous with the sense of touch. We may tell by feeling whether a surface is smooth or rough, hot or cold, wet or dry. While this is a very common meaning, it is not the meaning generally employed in psychology.

Feeling also describes the general state of health; as when we say that we feel bad, or sick, or well. It designates the general sensation which scarcely permits of being localized. It refers to the state of the body as a whole, and not to any special mental process. Closely related to this use of the word is one that indicates certain special sensations, as when we say that we feel cold or hungry. Cold and hunger are strictly sensations, and the use of the word feeling to describe them is no longer in conformity with the prevailing usage that discriminates sensation from the affective process. This use of the word feeling cannot be described as psychological, nor one in which it will be employed as a psychological term.

Feeling also has a use in the description of a picture, or other work of art. As there employed, it means a particular characteristic of the artistic production that renders it capable of appealing to the emotional or feeling side of the nature of the individual. It is rather a figurative use, and not at all scientific in its application. It is not truly a psychological meaning.

As a psychological term, the word feeling is used with many different shades of meaning, and it is necessary to discriminate them clearly in order to avoid confusion while reading the works of different writers upon psychology. We shall obtain a wrong impression of an author's thought if we put the same meaning into the word feeling in reading his works that we do when reading those of another. So serious is this discrepancy that many psychologists refuse to employ the term feeling, and seek some word that is not so well known, and which has not so many diverse connotations. But the advantage to be obtained from its use seems to justify the attempt to free it from undesirable associations and to make its meaning clear and definite.

One use of the word makes it mean merely pleasure and pain. Nothing else is feeling, and all feelings are either pleasures or pains. It would appear that this use of the word is too limited to meet general approval, and it is incompatible with the analysis of feeling that is made in this book. It implies that we may have a feeling of pain rather than a painful feeling; it asserts that pain is the feeling, rather than merely a property of it. Hence we shall not adopt this meaning.

Another use of the word designates by it an affective process of a particular degree of complexity. It is less complex than an emotion and more complex than an affection. The attempt is made to discriminate affective processes by means of their complexity, and to classify them upon that basis. It is doubtful if such an attempt can be satisfactory or very successful. It would be difficult to discriminate a complex feeling or affective process from a simple one, and even if it could be done, the relation so exhibited would scarcely contribute anything of value to our knowledge of the subject. It is necessary for us to recognize, however, that the word is sometimes thus employed, although such use may not commend itself to us.

A third function of the word makes it mean a combination of intellectual and affective elements. The total of a mental experience, especially if it is a relatively simple one, with all its elements, is called a feeling. This use is not far removed from the practice of those persons who speak of an intellectual feeling, by which is generally meant an obscure or indefinite perception of a relation not clearly defined. But to call the simple intellectual process in its totality a feeling is rather out of harmony with the present tendency to discriminate sharply the cognitive elements in a mental experience from the affective. If we were to employ the word in this sense to mean the totality of a mental experience, we should still need some term by which to discriminate the affective from the cognitive elements. It would seem preferable to reserve the word feeling for the affective elements alone, and to employ some other word to designate the intellectual or cognitive elements. Certainly, every mental process is capable of such an analysis, and the word feeling has already such important connotations with the affective elements that it is doing violence to the language of psychology to include cognitive elements within its limits.

Another use of the word limits it to those affective states that accompany ideas, or mental processes more complex and of a higher order than sensations, which involve the activities of the senses. Pain or pleasure—the affective conditions that accompany the activities of the senses—are not classed as feelings, but called by some other name; sensations, appetites, desires, or some other designation than feelings. The word feeling in this connection is reserved for the activity of some other portion of the human complex than the bodily organs; it is reserved for the activity of the mind, or the soul, or the self active entity that is assumed to be independent of the physical conditions. While the persons who adhere

to this use of the word would not so describe it, we may say that this use of the word feeling is limited to the affective states that are the concomitants of centrally initiated impulses, while it is distinctly not employed to designate the states that are accompanied by peripherally initiated impulses. It would seem as if this were scarcely a justifiable discrimination, since affective processes certainly accompany the activity of sense organs. Although it is employed by some good writers, there seems to be no sufficient reason for limiting the word feeling to this use.

Instead of the word feeling, the idea which it connotes is often expressed, in whole or in part, by other terms. Emotion is a very common synonym for feeling, and when so used it is given quite an extensive application. Darwin uses it in the title of his book *The Expression of the Emotions*. Many other writers have employed it to mean all that we shall expect to mean by feeling. The word emotion also has a variety of meanings, but as it is used by Darwin, it is almost completely synonymous with feeling in the widest sense of the word. Sometimes the word emotion is not completely synonymous with it but expresses an affective state of a higher degree of complexity. Affection, mood, sentiment, temperament express other degrees of complexity among affective processes.

Sensibility is sometimes used to express the entire range of the affective life. When so used, it is correlative to intellect and will. All mental life was once supposed to be capable of distribution into three great groups of powers: intellect, sensibility, and will. Sensibility was defined as the group of powers by which we feel. This use of the word is wholly inadequate to express the newer conception of feeling, and the word sensibility has almost disappeared from psychological literature.

Sensation is the most troublesome of all the synonyms for feeling in common use. The difficulty arises from a

failure to discriminate sensation as an intellectual, or knowing process, from the affective side of the process, which is properly called feeling or affection. Even in recent books of the highest authority the distinction is not clearly maintained. Formerly no attempt was made to discriminate the two processes involved in an activity of the sense organs, and this use of the word sensation persists. In this use it is almost completely synonymous with feeling, as described in the third function of the word above. In common speech today, even among well informed persons, sensation as frequently means a process characterized by pleasure or pain, as one which merely gives knowledge of an outside event.

However, among psychologists the tendency for a good many years has been to limit the word sensation to the intellectual process accompanying the activity of the sense organs, and to employ the word feeling, or affection, to designate the affective process that occurs at the same time. It is possible to discriminate by a process of abstraction the cognitive from the affective side of a sensory process, and the word sensation has come to mean properly the cognitive side. In order to avoid the misunderstanding that seems likely to arise from the use of the word sensation, some writers have chosen to employ the phrase *simple sentience* to express the cognitive process, and to use some other word, such as affection, to express the affective side of the same process. It seems, however, that the prevailing tendency is to limit the word sensation to the intellectual process, and to distinguish the affective accompaniments by another term. No harm will be done if we adhere strictly to the general custom among psychologists, and employ sensation to express the simple intellectual process that accompanies the activity of a sense organ, giving us knowledge, and making us acquainted with the quality of an object. We may use the term affection to express that kind of feeling which may

be pleasurable or painful, that accompanies the sensation, but by sensation we shall always mean a simple knowing process.

It is not strange that this confusion in the use of the term sensation should exist. Sense, sensation, sensibility—all contain the same root meaning, and at a time when the affective and cognitive elements were not clearly distinguished from each other, sensation was applied to both, and adhered rather more closely to the affective process than to the cognitive.

Instead of the word feeling, some of the most careful writers employ the compound form pleasure-pain to express the general affective process. This use of the term assumes that pleasure and pain constitute the feeling, and that there are no other processes that may be designated by that name, while every feeling is either a pleasure or a pain. As will be shown in later chapters, this determination of feeling cannot be maintained, and consequently some other form of expression must be employed. It will be shown that pleasure and pain are merely properties of feeling and not the feeling itself. To use pleasure-pain in this sense of the word is to commit ourselves to a certain theory of the nature of feeling that is not satisfactory.

The confusion in the use of the terms feeling, sensation, pleasure-pain, and pain is rendered greater than it would otherwise be by the fact that by many writers pain is considered to be a sensation in the purely intellectual use of the word. It is not considered to be a feeling, nor an affective process of any kind, but a purely intellectual sensation. It is believed to be as truly a sense as is the sense of temperature or the sense of touch. So wide spread is this conviction that it is necessary for us to examine the matter carefully and to state our reasons for failing to agree to the proposition.

The notion that pain is a sensation perhaps originated

with Goldscheider, who discovered the end organs for the sense of temperature and discriminated the sense of heat from the sense of cold. He believed that he had discovered the end organs of pain, or spots to which if a stimulus were applied a distinct sensation of pain was produced, unlike the sensation arising from the activity of other senses. He believed that the activity of the other senses would in no case afford the sensation of pain, unless there were pain spots or end organs of pain that should be stimulated at the same time or by the same stimulus. He believed that he had discovered that the pain stimulus was transmitted through definite columns of the spinal cord, and by inference, that we should find all pain impulses transmitted to a pain center in the brain. In several popular books on psychology and physiology we find a portion of the brain designated as the area for touch, pain, and temperature.

Goldscheider's exposition of the matter was very favorably received for several reasons. In the first place, the new psychology, which is distinguished from the old largely by the much greater emphasis which it lays upon physiological processes, had manifested a decided weakness in dealing with the feelings. The anatomical investigations of nerve structure, and the methods of experiment that had proved so successful with the intellectual processes, failed to accomplish equally satisfactory results when applied to the feelings. There existed a general impression that in some way the intellectual processes were paralleled by the feeling processes, and the simplest expression of this view was to postulate a parallelism in the nervous system, with one system of end organs, nerve tracts, and brain center for the intellectual processes, and another system of end organs, nerve tracts, and brain centers for feelings. Ladd, in his *Outlines of Physiological Psychology*, tolerates the suggestion by remarking (p. 388) "the tendency of recent evidence toward a some-

what complete separation of the nervous mechanism whose excitement produces feelings of sensuous pain and pleasure from that whose excitement results in the production of the sensations themselves." It is not uncommon to find in books on elementary physiology and psychology, diagrams in which the area of the feelings is located in the frontal lobes of the brain.

The above represents one tendency regarding the feelings that favored the adoption of Goldscheider's views. Another was a tendency to reduce the feelings to an intellectual basis and to diminish the difference between feeling and intellect, the tendency being to show that the two were in the last analysis identical; that feeling was an obscure, indefinite process which, when it should become definite and clear, would be sensation. That pain should be considered a sensation appeared to be the first step in that direction, and a promise that the exceedingly difficult problem of finding a physiological interpretation for feeling was in the process of being solved.

This attitude of the leaders of the New Psychology toward the interpretation of pain as a sensation was favored by the difficulties which the Old Psychology had encountered. Believing as they did that feeling was an activity of the mind, the older dualistic psychologists were unable to account for the pain involved in the activity of the sense organs; hence they were inclined to distinguish feeling proper, an activity of the mind, from pain, an affection of the physical organism. So the proposition of Goldscheider to regard pain as an intellectual sensation was consonant with the views of both kinds of psychologists. When Goldscheider reported that he had discovered pain spots on the skin, the accuracy of his investigations was readily accepted.

The evidence for regarding pain as a sensation may be summed up under four heads: First, that there are places in the body in which a stimulus will arouse only

sensations of pain without the sensation of touch. Such a place is the cornea of the eye. Second, that there are places, such as the inside of the cheek, in which the sensation of touch may be aroused without arousing the sensation of pain, no matter how strong the stimulus may become. Third, certain drugs, such as cocaine, will destroy the sensation of pain, while leaving the sensation of touch unaffected. Fourth, certain other drugs, such as saponin, will destroy the sensation of touch, while it leaves unaffected the sensation of pain.

The evidence furnished by these several lines of experiment scarcely seems conclusive. As will be shown later, each of the classes of facts that are relied upon to prove the sensational character of pain may better be explained by some other hypothesis. On the other hand, there is no suggestion of the presence of pleasure spots, or pleasure sensation, and pleasure is always considered the complement of pain. There is no special stimulus especially adapted to pain, as there is for every other sensation, but any stimulus that will establish an impulse in any other kind of a sense organ may be the origin of an impulse that is painful. When we put with this the fact that there are no organs in the skin that can positively be demonstrated to be the end organs of pain, we are justified in refusing to credit the notion that all pain is a sensation, and the result of the stimulation of special pain organs.

Pain occurs in the function of any sense whenever the intensity of the stimulus reaches a certain degree. The function of any sense organ, when stimulated in a moderate degree, affords pleasure, but when the stimulation greatly exceeds the pleasure-giving intensity, the feeling associated with the sensation is a painful one. Consequently, many of the best and most recent writers upon physiology have refused to adopt the theory. Morat (*Physiology of the Nervous System*, p. 402) says that

"Pain requires no special apparatus for its production. There is no organ of special pain sense, and there are no special conductors of pain. There is no system that properly belongs to it." This seems to express very clearly the most recent tendency among physiologists concerning the question of pain. We may properly conclude, then, that pain is not a sensation, but belongs to the affective side of mental life, and constitutes a property of feeling.

The truth of the matter seems to be that psychologists have discovered in the skin one or more sensations that are not touch nor temperature, which are not sharply characterized in themselves, nor sharply differentiated from each other. One of these, at least, has been injudiciously characterized as the sensation of pain, and we are permitted to infer that all pain arises as the concomitant of the stimulation of these particular sense organs. Itching and stinging are by some psychologists described as merely different forms of this same pain sensation. We are even required to subscribe to the paradox that pain may not always be painful, but that many times it is even pleasurable.

There is no objection to a writer using any word that he desires to employ to express an idea, provided he states at the outset the sense in which he intends to employ it, and adheres rigidly to that meaning. It is advantageous, however, to use any word in as nearly the ordinary sense as possible, since it renders it less difficult for readers to understand his thought. The word feeling seems to be the word which is most available, and the most nearly satisfactory to express the idea that constitutes the subject of this book.

By feeling we shall mean throughout this book any kind of an affective process, simple or complex, painful or pleasurable, vivid or faint. We shall mean by it any emotional state, sentiment, or mood. It will express any

activity that might by the older psychologists have been classified under the head of sensibility. We shall carefully discriminate feeling from the intellectual or cognitive process, and shall strive consistently to maintain this distinction. Such use of the word has abundant justification in the practice of many writers, although others have limited it very much in the manner described above.

At the very outset we are confronted with a difficulty in definition. We have already described feeling as any kind of an affective process, but it is as difficult to define affection as it is to define feeling. Feeling is something that every one knows but no one can define, since there is nothing simpler to which it can be compared, nor anything else that it can be said to resemble. We may define it as a mental process, and then discriminate it from other mental processes like sensation or cognition. An intellectual process such as sensation causes us to know something. It is a process that establishes a correspondence between our internal experience and the outside situation. It gives us knowledge of something, often of the outside world. By feeling we do not learn anything, but it is purely a subjective experience. It is a very satisfactory statement of Höffding that feeling might be defined as that in our inward states which cannot by any possibility become an element in a percept or an image.

When we describe feeling as an affective process we discriminate it from an intellectual process. But this renders it necessary that we should define affective process or affection. The definition of affection involves the same difficulty as does the definition of feeling, and for the same reason. But if we cannot make a logical definition of affection, we can at least point out some of its distinguishing characteristics by which we may know it. For our present purpose, we may define affection as any kind of a mental process that has for its conspicuous characteristic pleasure or pain. If we shall for the present

regard pleasure or pain as the affection itself, we shall establish a basis for discussion that may afterward be modified so that it shall be accurate. Pleasure or pain is not the affection itself, but merely a distinguishing characteristic, expressing not its true nature, but serving as an identification mark. Feeling, then, is any kind of an affective process.

SYNOPSIS.

1—*Sensation is a simple mental process that makes us acquainted with a quality of an object. It is a cognitive, or knowing process. It may be accompanied by a peripherally or a centrally initiated impulse, it may be vivid or faint.*

2—*Affection is a simple mental process that is purely subjective, gives us no information of the outside world, and has for its distinguishing characteristic pleasure or pain.*

3—*Feeling is any kind of an affective process, simple or complex, painful or pleasurable, vivid or faint.*

CHAPTER II.

THEORIES OF FEELING.

It is evident to every psychologist that our knowledge of feeling and the "state of the art" (to use the language of the patent office) is in an extremely unsatisfactory condition. Notwithstanding the enormous activity in psychological study in the past twenty-five years, our knowledge of feeling is scarcely in advance of that which existed before the advent of the New Psychology. It seems that the New Psychology has been scarcely more successful than the old in the study of the feelings, and that the processes of experiment and physiological investigation have so far failed to lend themselves readily to the study of feelings. Up to the present, it appears that James's theory of feeling has been the greatest advance that the New Psychology has made, and James's theory has failed to attain universal ascendancy.

It is necessary in studying the "state of the art" to know what theories of feeling have been held and have guided investigation. Some theory is necessary, or a large part of investigation will be utterly useless and wasted effort.

The first theory to be considered we may call the common theory, for it was formerly universal among psychologists, and is held today by almost all well informed persons who are not psychologists. This common theory assumes that feeling is an activity of a self existent, self active entity called mind, or soul, and is one of the three kinds of activities—thinking, feeling, and willing—of which this entity is capable. There is no cause for the

feeling except the self activity of the mind itself. The mind may feel in one way or another according to the circumstances, but it is not compelled to do so, nor is the feeling the result of outside circumstances, but only of the inside activity. The mind is the cause of its own feeling.

It is this conception of the nature of feeling that leads to the distinction between physical feeling, associated with sensation, and the activity of sense organs on the one hand, and mental feeling, or unpleasantness, unrelated to sensation on the other. Physical feeling is determined by the action of some outside force upon the body, while mental feeling is determined only by the activity of the mind itself. Hence it is that there is an indisposition to consider physical feeling, associated with the activity of the bodily organs, as feeling, but a readiness to relegate it to the domain of sensation, an intellectual, or at least, a non-emotional process.

Also, it is a consequence of this theory of feeling as an activity of the entity called mind that we are led to talk about the cultivation of the feelings. It is understood that the mind grows and becomes more skillful in any of its activities by practice. Hence practice in experiencing feelings will increase the facility of such activities, and feelings are cultivated by their exercise. Perhaps this is one of the most pernicious doctrines that has arisen from the common theory of feeling, and one whose origin is seldom recognized.

When a feeling has been experienced, it is then expressed. According to the theory, expression is not necessary to the feeling activity, but is merely a matter of convenience or indirect benefit. Hence there are expressive muscles some of which are believed to have little use except for expression. The feeling precedes the expression, and the expression is not necessary to the feeling activity.

Upon this theory of feeling, there is little that can be said concerning the relation of the feeling activity to the body or the nervous system. If we limit our use of the term feeling to the psychical or mental feeling, as distinguished from the physical feeling, the condition of the nervous system can have but little influence upon it. Whatever the connection between bodily state and feeling process may be, it is not a causal one, nor one of the most intimate kind.

The nature of the connection between the feeling activity and the intellectual process is not very satisfactorily determined, nor is it very intimate. The two are not inseparable, but each may manifest itself independently of the other. It is believed that the intellectual process precedes the feeling process, and that the feeling process is determined, in part at least, by the intellectual process. The person must know before he can feel, but the kind of feeling experienced is not necessarily dependent upon the thing that is known. The mind can feel as it wishes to feel, no matter what may be the nature of the intellectual process that precedes.

One other thing is generally assumed in the relation between intellect and feeling, as growing out of this common theory: namely, the stronger the intellect, the stronger the feeling. The mind that is vigorous is vigorous in all of its activities. If it is vigorous intellectually, it is equally vigorous affectively. The relation between the two is a direct one. It can readily be seen how such a conception of the relation between intellect and feeling is derived from a consideration of a theory rather than from an examination of the facts.

While this theory is stated above in its most extreme form, and some evident conclusions drawn that are seldom so bluntly expressed, something like this in a more or less modified form is the common opinion about feeling. It is unnecessary to state that modern psychol-

ogy knows nothing of this mysterious entity that is self-active, and whose self-activity occasions the thinking, feeling, and willing. It is impossible to consider the feelings as self caused, or caused by the self-activity of the mind. To postulate such a self active entity as a cause of feeling is to leave the domain of science and enter upon that of mythology. Much of our psychology looks for an explanation of the origin of feeling in the nervous and cerebral condition of the individual who experiences the feeling, consequently a more nearly adequate theory of feeling is demanded.

James's theory asserts that the expression of the feeling occurs first, and is the cause of the feeling itself. We are not first pleased and then laugh, but we laugh first and next experience the feeling. We weep and then we are sorry. We run or shriek, and then experience the feeling of fear. In this theory we have a direct contradiction of the common theory, which asserts that the feeling precedes the expression and is the cause of it. James's theory asserts that the expression comes first and is the cause of the feeling.

James's theory has received very wide acceptance and is believed in a more or less modified form by a majority of all psychologists today. It has been a very fertile theory leading to much valuable investigation, and exercising even more influence upon the study of other departments of psychology than upon the study of feeling itself. It conforms closely to the spirit of the New Psychology, and in that fact lies the principal source of its strength. Nevertheless, it contains implications incompatible with the facts, and which are capable of being disproved.

The interpretation of Mr. James's theory involves the following essential elements: The movement that we are accustomed to call the expression has essentially the na-

ture of a reflex. There is no mental process accompanying it, but it is the direct response of the muscle to the stimulus acting upon a sense organ. When the reflex, expressive movement occurs, a backward flowing impulse is established in the muscle that has contracted, and when this backward flowing impulse reaches the brain, the feeling is experienced. The origin of the nervous accompaniment of the feeling is the contraction of the muscle by which the feeling is expressed.

Mr. James argues the case for his theory very skillfully, and his arguments may be grouped into three different classes: First, he asserts that direct observation shows that the expression precedes the feeling. A person in great danger may escape from the danger, and only after the escape does he experience any of the feeling of fear. The movements by which he escapes are the expressive movements, and precede the feeling.

Examples of this kind may be cited in numbers, but probably as many examples of a contrary nature may be discovered. The answer to the argument is a direct denial of its universality, for it can be shown that not in every case does the expression precede the feeling. The evidence that the feeling precedes the expression is just about as strong as that the expression precedes the feeling. Even as it stands, there is a necessity for assuming that in many cases the expression which precedes the feeling occurs in some internal organ, the only evidence of whose motion is the feeling itself, or that the expression occurs in some situation where direct observation is impossible. It is even necessary to assert that in some cases the inhibition of the movement constitutes the expression itself.

When we have two contrary propositions, one of which seems to be supported by evidence about as strong as the

other, it is always wise for us to suspect that neither of them is true, but that the explanation will be found by looking in some other direction. Such seems to be the case in the present instance. The expression does not precede the feeling, nor does the feeling precede the expression, but feeling and expression occur at the same time. The expression is not the cause of the feeling, nor the feeling the cause of the expression, but both feeling and expression arise from the same cause and have a direct relation to each other through that causal condition. Certainly the feeling and the expression are not separated from each other by the long interval of time that both the common theory and the James theory assume that they may be. This fact alone should have been remarked, and should have influenced our decision.

The second argument advanced by the supporters of the James theory is that inhibiting the expression inhibits the feeling. In many cases this is true and in many others it is not true. Sometime inhibiting the expression of the feeling seems to increase it. Two boys who are angry, often become better friends after having given expression to their anger by a fight. The truth of Höffding's statement, that the concealment of a feeling, i. e., the inhibition of its expression, may cause it to penetrate deeper into the nature of the individual (*Psychology*, p. 332) is very generally recognized.

As will be shown in a subsequent chapter, there are three processes by which the expression of a feeling may be inhibited, and the feeling is diminished at the same time by two of the processes, while it is rather intensified by the third. All of us can inhibit the expression of feeling to some extent without destroying the feeling, or diminishing its intensity to anything like the degree that the expression has been inhibited. Where such contra-

dictory conditions prevail, it seems quite evident that the explanation offered cannot be the true one.

The third line of reasoning is somewhat like the second: that giving expression to a feeling, induces the feeling. Actors experience the feelings that they portray. Like the other arguments, this carries with it a partial truth. Some actors do experience the feelings they portray, but other actors do not. All of us in some degree, and some of us in a high degree, can express feelings we do not experience. The smoothness of social relations depends in a very large measure upon our concealing our true feelings and expressing feelings we do not experience. The woman who receives a caller and says: "O how glad I am to see you," then when the caller has gone away remarks: "That old cat, I hope she will never come here any more," is a living demonstration of the inadequacy of the argument. In fact, it was a great man who said that "To lie, gracefully, is the chief accomplishment of women."

We may readily admit that the best way in which to inhibit the feeling is to actualize the condition that results in the non-performance of the action which is its expression, but we do not necessarily agree to the proposition that such inhibition of the feeling demonstrates that expression is its cause. We may readily admit that the best way in which to engender the feeling is to do the things that renders the expression natural and easy, without committing ourselves to the proposition that the expression engenders the feeling. It is possible to find a more satisfactory explanation of the relation between the feeling and its expression than James's theory presents.

There is one other consideration concerning James's theory that ought to be mentioned. James's theory supposes that the expression which causes the feeling is a reflex. It is the very nature of a reflex to be accompanied

by no feeling. The reflex is the direct response of the tissues to a stimulus, and in no case is it accompanied by any feeling. Many of our most completely habitual actions approximate closely to a reflex, and as they more and more nearly do so, feeling disappears from them. It is a universal law of psychology that feeling tends to disappear from an habitual act, and our most habitual acts resemble reflexes so closely that they are sometimes called secondary reflexes. It would seem, then, that if the reflex is the cause of the feeling, our most habitual actions ought to be accompanied most uniformly by feeling, which is not the case.

But, if it be called to mind that it is not the reflex itself that causes the feeling, but the backward flowing impulse that originates in the contraction of the muscle, we are committed to a still more dangerous proposition. The backward flowing impulse is transmitted to some brain center, which we may call the muscular center or the center for muscular sensation. When impulses are transmitted through this muscular center, we experience the muscular sensation. All this may readily be admitted, following the analogy of the sight center, the hearing center, and the centers for taste and smell.

This would imply, then, that all the muscles of the body have nerves running into this muscular center, and since it is the important center in the production of the feelings, we have a definitely localized portion of the brain in which every feeling originates. Such a proposition would be very difficult to demonstrate, and would seriously complicate any explanation of the relation between feelings and the intellectual processes that are experienced at the same time. In fact, it would seem to render unnecessary any direct relation between the two. Such a proposition would in itself lead us to distrust the

accuracy of the determination of feeling according to James's theory.

I have characterized James's theory as the most important contribution of the New Psychology to the study of the feelings, but its importance is not a consequence of its truth. It perhaps would never have accomplished the amount of good that it has done had not somebody believed it to be true, but the good that it has accomplished is not a function of its truth.

One of the most significant results that have come from a discussion of James's theory is the great importance that psychologists have been led to attach to the muscular sense. The muscular or kinaesthetic sense has come into psychology like a new continent into geography. So important is its discovery that psychologists have been completely unbalanced by it, and have gone to the unwarranted extreme of declaring that all consciousness is motor, no impression without expression, the sensory stimulus must express itself in some form of action before a perception can be set up, etc. The advocates of this extreme form of the sensori-motor arc conception of consciousness do not shrink from the conclusion that we think with our muscles rather than with our brains, although they seldom state it so bluntly. If we were to accept the conclusion, that all consciousness is motor and a muscular movement is a necessary condition for any kind of thought, we must logically expect to find that the person who most persistently and most vigorously exercises his muscles is the most vigorous thinker and inevitably does the greatest amount of intellectual work. The direct contradiction of this proposition is true.

When stated thus in its extreme form, the advocates of the sensori-motor arc conception of consciousness find it very difficult to account for the fact of mental action, or how any kind of a mental process can determine what an action shall be. Neither the intellectual process nor

feeling appears to be a determining factor in the action. Then too, the fact seems to be overlooked that the function of the cortex is the interposition of a resistance between the sensory stimulus and the motor response, which destroys the sensori-motor arc, and is fatal to the theory.

The muscular sensation enters into the composition of very many perceptions, as well as into many other mental processes. It seems safe to assert that all mental action is just about as much muscular as it is visual or auditory or tactual. However much emphasis we may lay upon the muscular sensation, it is unwise to disregard the importance of the other senses. Even if we admit that every feeling is accompanied by some muscular contraction that we may call the expression, and that every intellectual process does eventuate in action, it would still be incumbent upon us to show that such action is a necessary condition rather than an inevitable accompaniment. It may be perfectly safe to assert that a wagon cannot run without noise, but it becomes exceedingly difficult to demonstrate that the noise pushes the wagon along.

James's theory has been rendered more acceptable to psychologists because in it is found a means of connecting the feelings with the physical organism in a way that the common theory did not do. The intellectual processes had been associated with the nerve processes quite satisfactorily, and James's theory furnished a means of understanding how a similar connection might be made with feeling. It was directly in line with the onward movement of the new psychology at a time that the new psychology was needing some physiological interpretation for feeling.

While James's theory is the oldest, best known, and most widely accredited of all theories of feeling that have their origin in the new psychology, it has not been universally accepted, but many other theories have from

time to time been advanced. We may readily recognize two different types.

One type is of the kind that may be called physiological, seeking an explanation of the feelings in the nervous conditions that determine them. The other type disregards largely the physical conditions, and may be called the purely mental, or psychological, type of feeling theories.

Of the latter, one kind of theory regards feeling as the accompaniment of a struggle between ideas or other mental processes. Thus Hamilton says (*Metaphysics*, p. 171) "pleasure is the reflex of unforced and unimpeded ideas," while Ribot, quoting Krafft-Ebing (*Emotions*, p. 72), says "We must consider psychic pain and the arrest of ideas as coordinate phenomena."

In this type of theory there is the recognition of a struggle, hesitation, and delay in the psychic processes. If the ideas are conceived to be the active agents, as believed by the Herbartians, feelings originate from a struggle between ideas. With others, indecision, hesitation, delay, and doubt are the conditions that influence and give rise to feelings.

Of the physiological type of theory there are many variations. We may, however, notice two distinct groups: the peripheral and the central. The peripheral group of theories considers the determining concomitant of feeling to be the activity of some peripheral organ, either the contraction of some muscle or the activity of some other sense organ or gland. The central group of theories assumes that the concomitant of feeling is the activity of a cortical center which may have been induced in some one or another of many different ways. James's theory as described on page 17 is a central theory, although, as it was originally stated and as it is still understood by many persons, it was a peripheral theory.

Meynert regards pain as originating in the opposing

activities of two kinds of reflex movements, associated with the blood vessels and the muscles. As a result of these two kinds of movements the conductivity of the nervous tissue is diminished and the result is a feeling of pain. This explanation is limited to physical pain, and needs to be very much modified before it can apply to purely mental feelings that are either painful or pleasurable. Like James's theory, it supposes the origin of feeling to be in the movements of some other substance than the nerve tissue.

Spencer also regards feeling as associated with some kind of obstruction. He says: "Physiologically considered, a disagreeable course of action is one in which compound feelings have to issue in compound actions through complex nervous structures that offer considerable resistance. (*Psychology*, I, p. 580.) Also he says: "Where action is perfectly automatic (without resistance) feeling does not exist" (p. 478).

It would seem from this that Mr. Spencer seeks a physiological explanation of the origin of feeling in the impeded action of the nervous current. Whether he would make such an explanation apply to anything else than a painful feeling, or whether he would explain by it any other property of feeling than the painful, or perhaps the pleasurable tone, it is impossible for us to say; but it is worthy of note that this important characteristic of feeling is regarded as having its concomitant in the obstruction or resistance to the nervous current.

Henry Rutgers Marshall regards pain and pleasure as the concomitants of a physiological process depending upon the relation between receipt and expenditure of nervous energy. If the outflow is greater than the intake, the accompanying feeling is pain; while if the outflow is less than the intake, the resulting feeling is pleasure. If the two are exactly balanced, the feeling is one of indifference. "Pain is experienced whenever the physical reac-

tion which determines the content is so related to the supply of nutriment to its organ that the energy involved in the reaction is less in amount than the energy which the stimulus habitually calls forth. Pleasure is experienced whenever the energy involved in the reaction to a stimulus is greater in amount than the energy which the stimulus habitually calls forth. Pleasure and pain are primitive qualities of psychic states which are determined by the relation between capacity and activity in the organ, the activities of which are concomitants of the psychoses involved." (*Pain, Pleasure and Aesthetics*, p. 204.)

There is much to be said in favor of such an hypothesis as this, and many theories that have been propounded in recent years involve something of the same ideas. The principal criticism of Marshall's theory is that it is too limited, making feeling synonymous with pleasure and pain, and therefore it is not sufficiently comprehensive to explain all feelings. It scarcely furnishes an explanation of why one feeling should differ from another, as the feeling of fear from the feeling of anger. Both may be painful feelings, but they are discriminated by other things than their painful or pleasurable character.

Dr. Paul Sollier, in his book on the *Mechanism of the Emotions*, meets the question raised by James of the order—perception, emotion, expression,—by the assertion that the expression and emotion are concomitant and not sequential. Also, he considers the physiological process that gives rise to the feeling to be a central, cerebral, not a peripheral process.

Another group of theories consider feeling as the concomitant of a physiological process occurring in the brain, and consisting of the radiation of a nervous impulse out of the centers through which it is passing in order to give rise to a mental process. Bain, (*Mind and Body*, p. 52): "When an impression is accompanied by feeling, the aroused currents diffuse themselves freely

over the brain, leading to a general agitation of the moving organs as well as affecting the viscera." So Höfding, quoting Richet, says that "pain without memory and without radiation would be no pain at all;" also, a very significant statement, that "Probably it presupposes the subduing of a great resistance in the central nerve organs."

A very recent theory of feeling is that of Professor Max Meyer who says that "The correlate of pleasantness and unpleasantness is the increase or decrease of the intensity of a previously constant current, if the increase or decrease of the intensity is caused by a force acting at a point other than the point of stimulation. (*Psychological Review*, 1908, p. 307.)

It will be observed in all these theories that scarcely any two of them cover exactly the same points. Hence it is that nearly all of them are partial, explaining only some features of the phenomena of feeling, and not at all adequate to serve as a true theory. The theories that limit themselves to a consideration of pleasure and pain must of necessity be inadequate.

It appears that any theory of feeling to be satisfactory must be a physiological one, or must correlate the mental experience of feeling in some way with the physiological process. This is the tendency of present day psychology by means of which the greatest progress has been made, and the field of the feelings is at present exceedingly promising. In order to be a satisfactory theory, it must account for the specific difference in feeling, i. e., how the feeling of fear has become different from the feeling of love. It must account for the difference in intensity, as well as the painful or pleasurable character of it. It must be able to describe the relation between feeling and expression, as well as its relation to the cognitive process, and other forms of mental activity. None of the theories that have as yet been presented do all of these things, and we have still a satisfactory theory to discover.

CHAPTER III.

THE DATA.

The greatest need in the study of the feelings today is some understandable hypothesis that shall coordinate all of the facts at present known, and guide our observation and experiment. Much has been learned about feeling, and much more remains to be discovered. That our energy may not be misdirected, we need a working hypothesis.

Any hypothesis is better than none. An accumulation of particular instances increases our knowledge in arithmetical progression, but the discovery of particulars guided by a working hypothesis increases it in geometrical ratio. It is believed by many persons that all of our knowledge takes on the form of hypothesis, and Haeckel goes so far as to say that knowledge is impossible without hypothesis. Certain it is that every great discovery in science, or in any other department of knowledge, has been rendered possible, and has been accomplished, by the use of hypotheses.

Any good hypothesis must be capable of being understood. Many of the propositions advanced in psychology, which might be called hypotheses, violate this first canon. As in the study of mental phenomena, the physiological processes that accompany them have always contributed to furnish the first intelligible ideas, so a purely physiological hypothesis of feeling will contribute most to its understanding.

Any good hypothesis must be framed in such a way that it will not be contradicted by any of the facts already known. It must subsume under one law all known

facts, but this does not imply that every fact that is known must be taken into account in making the hypothesis. A very large number of facts may obscure the true theory that is found to unite them all. It is better to consider a smaller number of facts that are significant, than a larger number, many of which are less distinctively so. When by a proper employment of the significant facts a satisfactory theory has been advanced, it may be seen that some of the facts already known are susceptible to a different interpretation than that which has already been put upon them. Our search, then, must be first for the significant facts.

As it seems to the writer, the following facts are especially significant for feeling:

1—for every mental process there is a corresponding physiological change.

The evidence for the truth of this proposition is so nearly complete that it will be accepted by almost every person acquainted with the present state of psychological knowledge without any question. It is possible that persons persuaded of the independence of the mind will feel that, while in many cases there is a physiological change accompanying the mental process, such a connection is not in all cases demonstrable, and is not even necessary. But in so many cases we are able to demonstrate a corresponding physiological change, and in no single instance is it possible to demonstrate that there is a mental process without the physiological accompaniment, that there can be little objection to making the proposition universal, and assuming it to be true in all cases.

It will be observed that in the proposition as stated, there is no attempt to determine what is the nature of the connection between the mental process and the physiological change that accompanies it. So far as the statement goes, the mental process may be the cause of the physiological change, the physiological change may be the cause of

the mental process, or there may be no causal connection between them. It may be that the two are merely parallel, without there being any other kind of a relation between them than that which is manifested by two clocks in different places, both of which keep accurate time. But it is not necessary for us to assume any explanation of the cause of the concomitance, but merely to assert that there is a correspondence. Whenever we find a particular mental process, we always find a corresponding physiological change, and if we observe a particular physiological process, we may be sure that the corresponding mental process is going on.

We can observe a mental process that occurs in our own experience directly, but its interpretation is difficult, and it is not possible always to picture it in visual, auditory, or tactual images. Hence we shall find a decided advantage in imaging mental processes in physiological terms as soon as we have recognized what is the nature of the physiological process that is their invariable accompaniment. We shall find the same advantage in picturing mental processes in physiological terms that we find in physics in representing forces by lines, or measuring force in terms of the movement of matter. The employment of lines to represent forces has completely transformed the science of physics, and we shall expect that the same kind of transformation will occur in psychology as soon as the physiological interpretations are generally adopted. The great difficulty up to the present has been to discover or imagine what may be the physiological concomitant of some of the most important mental processes, such as the feeling and the will. It is in the field of these processes that the dualists have insisted that no concomitance is possible, and that feeling, especially in its more complex forms, has no determinable physiological accompaniment. Even in the most complex intellectual processes it has been believed that the demonstration of

concomitance was impossible. "How do the cells explode in a syllogism?" was the poser presented by one of our great philosophers. What physiological process corresponds to the uplift of soul that is experienced in looking upon the Sistine Madonna? Nevertheless, no one has ever experienced an uplift of soul when the physical organism was missing, and even when it was out of repair the uplift was startlingly wanting.

2—The physiological change that accompanies the mental process consists of the transmission of a nervous current through a nervous arc.

It is true that other physiological processes, such as the change in heart beat, greater blood tension, visceral symptoms, etc., occur at the same time, and many persons, emphasizing these other physiological features, are ready to insist that they must be considered a necessary part of the physiological concomitant. It will appear, however, that these muscular and visceral changes are extraneous indications of the nervous current, rather than primary elements in the physiological change which directly accompanies the mental process.

The word current is derived from a word that means to run, and is strictly applied to the movement of a stream in which there is a direct translation in space of the particles of water. When we apply the term to a current of electricity or to a nervous current, we shall need to extend its meaning and to omit some of the characters that are found in a river current, while retaining the essential features that are common to all currents. By the term current, as we apply it to the nervous system, we mean the changes in successive molecules that constitute the cells and fibres of the nervous arc. There is no thought of the translation of any particle of matter from one end of the arc to the other. But we do recognize that, when from any cause one molecule of an arc undergoes some kind of a change, the molecule next to it changes immedi-

ately afterward. The change in molecule number 2 induces a change in molecule number 3, until finally every molecule in the length of the nervous arc has been changed.

The nature of this molecular change which constitutes the current is difficult to determine. More than fifty years ago, Herbert Spencer demonstrated that it must be some kind of a molecular change, and later it has been shown that the change in the molecule is a change from a colloidal to a crystalloidal condition and back again, occurring from ten to twenty times in a second.

We readily recognize the fact that the molecules which make up the nervous system are exceedingly complex, consisting of many atoms very loosely bound together. It is characteristic of complex molecules to undergo changes very readily of a great many kinds, especially if the molecules contain atoms of nitrogen. The processes of chemical analysis are too crude to deal very successfully with organic molecules of such a high degree of complexity as those found in the nervous system, so that we have recognized only a few substances in the composition of the nervous tissue, but in those few substances we have examples of perhaps the most complex molecules known. Whether protagon is a simple substance, or a mixture of two or more, investigations into its nature have shown the exceedingly complex nature of the molecules which compose it. One of the best determinations of its nature assigns to its molecular structure five hundred and nine different atoms. A structure of such a high degree of complexity must of necessity be very unstable, and its constituent molecules in a state of constant rearrangement and readjustment, hence we find that very little force is necessary to initiate a change that is transmitted through a nervous arc. Forces that are too small to be measured by physical means may be sufficient to affect a molecular apparatus, which is more

sensitive than any that can be constructed in a physical machine shop.

An isomeric change is one that consists of a change in the arrangement of the atoms of a molecule, without there being any change in their number nor in the identity of the atoms that enter into the molecular composition. It may be necessary to modify somewhat our conception of an isomeric change in order to make the molecular change that occurs in the nervous current come under its definition.

It seems most satisfactory to think of the change that occurs in the initial molecule of the nervous arc, which is first affected by the force impressed upon it, as consisting of the jarring loose and driving off from the molecular combination, of one or more atoms. These loose atoms, moving with atomic speed, strike the next molecule, which is not in physical contact but within physiological communication with it, and drive off from it one or more atoms which pass to the next. In this way, successive molecules are affected, the same kind of a change occurring in each, thus necessitating a new arrangement and a new grouping of the atoms in successive molecules until the final molecule in the nervous arc is reached. The final displacement of the atoms affects the molecules of the organ with which the nerve is connected. If the nerve is one that terminates in a muscle, the final atom in the nervous arc that is driven off affects the initial molecules of the muscle, and muscular contraction follows. If the nerve along which the current is transmitted is an afferent nerve, the molecular change may be continued throughout different brain centers, being finally carried into a current connected with some outgoing nerve, or possibly having its force exhausted in the center itself, or in the neuroglia between the cells.

It will be seen that in this explanation, which seems to furnish an understandable method of interpreting the

activity of the nervous current, that not the same atoms constitute the molecule after the change occurs which constituted it before. The atoms may be of the same kind, but they are not identical. In this case, the change that occurs does not perfectly satisfy the definition of an isomeric change, but no test that could be applied would discover any difference between it and the one that is here described.

But we are not limited in our speculations to a change in molecules depending upon the transfer of atoms. Recent discoveries concerning the nature of the atom indicate that there is an enormous amount of force latent in the structure of the atom itself. The atom is composed of many corpuscles, or electrons, from one thousand to two hundred thousand in each atom, which are moving with velocities comparable to the speed of light, whose equilibrium is easily disturbed. It is necessary for us to consider the possibility at least, of this change in successive molecules that constitutes the nervous current, consisting of the transfer of corpuscles from one atom to another, or from one molecule to another, either with or without the transfer of atoms described above. We have here a source of power previously unrecognized, that enables us to answer many objections concerning the origin of the force that is liberated, and the lack of quantitative equivalence between the exciting stimulus and muscular force which we were unable to answer before.

3—Time is required for a nervous impulse to traverse a nervous arc. It will be seen from the previous exposition that the present proposition follows as a logical necessity. If one molecule must undergo a change before the second can change, the two are not simultaneous but successive, and the changes in the two terminal molecules of the nervous arc will be separated by an interval equivalent to the sum of the differences between the changes in the entire number of pairs of successive molecules.

But we are not limited to a theoretical demonstration of the fact that the transmission of a nervous impulse requires time. The measurement of transmission time, physiological time, or reaction time is one of the simplest of laboratory experiments, and one of the most impressive. This, which Müller fifty years ago believed would be forever impossible, has become the commonplace of elementary physiology today.

The instrument by means of which reaction time is measured is called a chronoscope, and it is capable of measuring intervals as small as the one thousandth part of a second. As the demonstration is usually made, a subject is placed behind a screen in such a way that the instrument is not seen by him. One of his hands is touched with a key which releases the pendulum of the chronoscope. As soon as the subject feels the touch, he presses a key with the other hand which stops an indicator. The indicator is carried along with the pendulum until the key is pressed, so that the distance that the indicator is carried along with the pendulum, as measured on a scale over which it passes, registers the interval between the release of the pendulum and the stopping of the indicator. But the release of the pendulum is coincident with the touching of the hand, and the stopping of the indicator is coincident with the pressing of the key. Hence the time that is measured is the interval between the starting of a nervous impulse in the nerve endings in the skin and the contraction of the muscles that move the finger.

This total reaction time is capable of analysis into several parts; First, there is the time necessary to compress the skin over the end organs of touch; Second, the time necessary to start the impulse in the nerve or the end organ; Third, the time of transmission from the end organ to the brain center for touch; Fourth, the time required to transmit the impulse through the touch center; Fifth, the time required to transmit the impulse from the

touch center to the motor center; Sixth, the time required for the impulse to traverse the motor center; Seventh, the time required to transmit the impulse along the outgoing nerve to the muscle; Eighth, the time required to transfer the impulse from the nerve to the muscle; Ninth, the time required for the muscle to contract; Tenth, the time required for the contraction to move the key, or the time of the compression of the tissues between the muscle and the key.

All of these various operations, including the time of the transmission of the electric current through the two circuits, are so short that they may be omitted without very much error, except the transmission of the nervous current along the nerve, through the brain centers, and from one brain center to another. The time required for all the others is, under the ordinary conditions of measurement, within the limit of experimental error, and more error would be caused by trying to take them into account than by omitting them from consideration altogether. The usual amount of reaction time thus measured ranges around the time of 187 thousandths of a second. It varies with many circumstances. It varies with different individuals, with the same individual in different senses, with practice, fatigue, state of health, intensity of attention, and whether the attention is fixed upon the hand that receives the impression or the hand that responds by pressing the key. But no matter how much variation there may be, there is always a measureable reaction time, and it is never reducible much below 100 thousandths of a second.

4—It requires from twelve to twenty times as long to traverse a given distance in the brain as a corresponding distance in a nerve.

This fact has been recognized by every one who has ever investigated the matter. Helmholtz, Wundt, James, Ribot, Ladd, all have asserted it unqualifiedly. In a nerve

the rate of transmission is constant and relatively rapid. The rate of transmission does not vary widely from 100 feet in a second, which, while it is very slow in comparison with the speed of light, electricity, or even sound, is rapid compared with the rate of transmission through a brain center. In a brain center the rate is slow and exceedingly variable.

Let us take a concrete example, from an experiment in the writer's classes. One student shows a reaction time of 187 thousandths of a second. The distance that the impulse travels from the point on the hand that is touched up to the brain is about three feet. The distance from the brain to the muscle that moves the finger which presses the key is about three feet. The nervous impulse, then, must travel six feet in the nerve. But the rate of transmission in the nerve is about 100 feet in a second, so in order to travel six feet, six one-hundredths of a second is required. The remainder of the time, which is 127 thousandths of a second, is the time required to traverse that portion of the brain which constitutes a part of the nervous arc. The nervous impulse must pass through the touch center on the right hemisphere, go along an association fibre over to the motor center for the hand on the left side of the brain, and go through the motor center. This distance in the brain cannot be greater than six inches, and may be much less than that. Then too, the rate of transmission between the two centers if it is along an association fiber, is the same rate as the transmission in a nerve, which still further diminishes the distance that we need to consider. At any rate, the distance of six inches is the greatest possible that we can estimate it to be, and any shorter distance renders the demonstration so much the more impressive.

Let us suppose that this time, 127 thousandths of a second, is the time required for the nervous impulse to travel six inches in the brain. To go one foot would re-

quire twice that time, or 254 thousandths of a second; and to go 100 feet would require 100 times as long or 25.4 seconds. So we see that in this case, the time of transmission is more than twenty-five times as great as is that of transmission for the same distance in a nerve.

How shall we account for the slow rate of transmission? There must be some condition in the brain center in which it differs from a nerve, that makes the transmission slow. The effect of this condition we may call resistance, without determining what may be its nature or its cause.

5—Our fifth significant proposition is that no feeling in ordinary circumstances accompanies the transmission of an impulse along a nerve, but feeling is experienced only when a nervous impulse passes through a brain center.

The evidence of this is found in the phenomena of reflex action. A reflex act is the direct response of the protoplasm to a stimulus without the mediation of an intellectual process. There is no feeling accompanying the pupillary reflex, nor of the knee jerk, and any other reflex is of the same nature. It is true that, after the reflex has occurred, a recognition of it may establish a mental process that may be accompanied by a feeling of surprise, or some other kind of a feeling, but the feeling comes as a result of the transmission of a nervous impulse through a brain center, and not the transmission through the nerve that has been traversed in giving rise to the reflex activity.

It will be noted above that I have said under ordinary circumstances. In pathological cases, such as neuritis, where there is an inflammation of the nerve tissue itself, there is much feeling, much pain, accompanying the transmission along a nerve. But this is merely another fact that corroborates the proposition about to be advanced, that the feeling varies as the resistance encountered varies. I know of no measurement of the transmission

rate through a diseased nerve, as in cases of neuritis, but we should expect that the rate would be slower and indicative of a greater resistance encountered.

6—Practice diminishes reaction time. The amount of this diminution is easily measured in any particular individual, but every person shows improvement as the result of practice in reacting to a chronoscope. But we need no chronoscope to demonstrate the fact that a person by practice becomes more skillful in the execution of any act, and the amount of improvement that may be made in performing complicated acts and series of acts is a constant source of amazement. The fingers of a skillful piano player indicate the exceeding rapidity with which it is possible to execute muscular movements, and the increase in rapidity with which nervous impulses may be transmitted.

It will readily be recognized that there is a physiological limit to the degree of improvement, and the amount of decrease that is possible by practice, but in such cases as that just mentioned, it seems that the limit closely approximates the rate of transmission in a nerve itself. When such an approximation has been made, the action closely resembles a reflex, and partakes of the reflexive character in being accompanied by diminished feeling.

7—This brings us to our seventh significant fact, that feeling tends to disappear from an habitual experience.

This is a fact of every day experience and observation. The process that is accompanied by delightfully pleasant feelings at first, ultimately begins to pall, and finally becomes, not painful, but monotonous, and no longer capable of furnishing pleasure. Then we feel the necessity of making a change. It may be that the road we follow in passing to our school or daily work becomes monotonous, and we desire to change our route. The arrangement of the furniture in our room no longer seems to us

so satisfactory as it did at first, and a new arrangement is desirable. The same dishes on the table every day lose their attractiveness. We occasionally like to listen to a new preacher, or a new teacher, or a new lecturer. Change is necessary to keep away monotony. The feelings we experience when we look at a picture upside down, or a landscape with our head inverted, or a scene on the ground glass of a camera, are very different from those that are felt when seeing them in the ordinary position.

Even acts that are at first painful may lose their painful character, become pleasurable, and end by becoming monotonous. Such seems to be the case with reading. The process of learning to read is frequently a painful process, not only to a little child but to a grown-up. Any one who recalls his experience in learning a new language remembers that after a sufficient amount of experience it ceased to be painful, became pleasant, and ultimately the reading itself, in which the painful or pleasurable character inhered, was monotonous.

8—Reaction time in children is greater than in grown-ups, and reaction time is greater in uneducated persons than in educated ones.

In making this statement in a general way it must be recognized that there is a great deal of individual variation, so that the truth of it will be manifested only when we take the average of large numbers of each class of persons indicated. There are some children whose reaction time will be shorter than is that of certain grown-ups, and there are individual persons who are uneducated who will manifest a shorter reaction time than other persons who are educated. But there can be no question that the average of a large number of persons of each kind will show that the rule as stated above is true.

This would seem to imply, also, that the kind of experience incident to growth, in the case of children, and of

education in the case of educated persons, involves the kind of practice that results in the decrease of reaction time. Growth in children, and a better organization of the brain centers, formation of association fibers, practice and experience, the continuous traversing of the brain tissue by impulses in all directions, naturally leads to such modifications of the brain tissue and brain centers as to facilitate transmission in every way. The same explanation is possible in the case of educated persons. The processes of education demand much mental experience, causing portions of the brain to be traversed by impulses which, without them, would be scarcely touched. The statement will hardly be denied, and there will be little trouble experienced in understanding that it is a natural result from the great variety of neural experiences incident to growth and to education.

9—Little children and uneducated persons are more influenced by their feelings than are grown-ups and educated persons.

Little children are admirable examples of exaggerated feelings. It seems as if the life of a little child is largely of that nature. Children laugh or cry, doing one about as readily as the other, and one or the other process seems to be in progress a large part of the time. The child is scarcely an intellectual being, and is incapable of doing very much intellectual work of any kind. He acts in accordance with his feelings, and not in accordance with any judgment, such as an older person would inevitably make. In the ordinary course of development, the feelings come to be superseded by intellectual processes, and no longer exercise the dominant place in the mental life of a child that they previously did.

The same kind of a change occurs in the feelings of an educated person. It is among the uneducated, uncultured persons, that as a rule we find the feelings exercising a predominant influence. The actions of uneducated per-

sons are most likely to be determined by their likes and dislikes, their prejudices, suspicions, aversions, appetites, desires. They are extremely susceptible to influences, which in a higher degree of culture and education would produce little effect.

In consequence of these facts, which scarcely admit of question, we are led to look with suspicion upon the expression so frequently used by many writers, "The cultivation of the feelings." If by cultivation of the feelings is meant such a course of treatment as will intensify them, the phrase is altogether misleading and wrong. The feelings are most intense before any cultivation is attempted. The only rational meaning that can be put into the phrase is to mean by it such a course of treatment as will result in a decrease in intensity of feelings, and a substitution of some other element in mental life as a determining factor in the production of action. The phrase seems to have originated in a thorough misapprehension of the nature of feeling. It is possible to cultivate the intellectual processes, and the assumption seems to be made that the feelings are correlative to the intellectual processes or powers, and are to be cultivated in the same way. A proper understanding of the nature of feeling will show that such a conception is thoroughly unjustified, and that the cultivation of the feelings is really a cultivation of the intellectual processes of perception and judgment, leading to a proper determination of the things that it is desirable to experience feeling from, and the kind of feelings that ought to be experienced in any given situation.

10—Pathological conditions may modify reaction time. It is noticeable that idiots have, in general, a very slow reaction time. In cases of degeneration, when a person sinks into a condition bordering upon idiocy, the reaction time becomes very much lengthened. The contrary effect is observed in those pathological cases that develop into

acute mania. One of the symptoms of oncoming maniacal conditions is frequently a shortened reaction time.

Even when the pathological conditions are not such as to be particularly noticeable, we can recognize that the reaction time will be modified in accordance with them. When a person feels stupid, or depressed, or fatigued, the reaction time is likely to be much lengthened. On the other hand, when there is noticed an excessively nervous condition, the reaction time is likely to be shortened.

11—Pathological conditions are associated with a deviation from a normal condition of feeling.

Idiots are notoriously devoid of feeling. Not only are they feebly sensitive to physical conditions that in others are productive of pain, but their perception of touch, temperature, vision, and hearing are likely to be below the normal. In the cases of maniacs, we find that there is a heightened intensity of feeling. In many cases, one of the first symptoms of oncoming insanity is an increase in the disposition to become angry, or to experience an intensified feeling, usually of a painful character, although in the early stages, the increase in feeling may be of a pleasurable nature.

It is a matter of common observation that the state of bodily health at any time modifies very much the nature and extent of our feelings. When we are fatigued, or hungry, or suffering from some other kind of physical pain, the things that would under ordinary conditions cause no apprehension or annoyance, will occasion serious worry.

12—No feeling is ever experienced that is not accompanied by some kind of intellectual process.

In the case of sensation, the sensation makes us acquainted with some quality of an object, and such an intellectual process may be accompanied by some kind of feeling. But the sensation must of necessity be discriminated from the feeling that accompanies it. So no feeling

of exaltation nor rapture can ever be experienced without a perception of some kind of a situation accompanying it, and to which it is appropriate. The only way that we can experience any kind of a feeling, such as pride, is to contemplate or image the condition in which we take pride. We experience the feeling of anger only in contemplating some situation, either actual or imaginary, that is consonant with the feeling. No feeling is ever experienced alone. There is no such thing as a pure feeling. It may be that the feeling element and the intellectual element vary widely in the proportion of each, but the intellectual element can never completely disappear from any experience in which feeling is aroused.

13—The intellectual content of the mental process determines the kind of feeling.

This is what Höffding means when he says that the differences between feelings we must explain by means of the cognitive elements that are combined with them. (*Psychology*, p. 222.) It is true that the same situation may appeal to one person in such a way as to be accompanied by one kind of feeling, while in another person the same incident may arouse a totally different kind of feeling. But we must understand that it is the perception of the entire situation which constitutes the intellectual process. The same occurrence or event gives rise to the perception of a whole series of relations in one person that are unobserved by another. This difference in what is perceived by the two persons arises in consequence of the different experiences, different amounts and kinds of knowledge of other things that bear a relation to it, and to the difference in the relation it holds to one's own life. The intellectual process that accompanies and determines the specific character of feeling consists of the perception of the entire series of circumstances. It is not merely that of the single event, but includes the remembered previous experience of the person.

These, then, are the things that appear to be significant and which need to fit into any theory of feeling that may be made. It is not meant that no other facts of feeling are known, but that we have here as wide a range of facts of diverse kinds as is necessary to enable us to form a comprehensive theory of feeling. When we have our theory advanced, we may test it by means of the other facts that are known. If it is not comprehensive enough to embrace all the other facts, our theory must be discarded or else modified into conformity with them. It may be that some of the facts already known, and which seem at first contradictory to our theory, are susceptible of such modification and interpretation that they not only fit into the theory itself, but furnish the strongest kind of an independent verification of it. At least, it is not in a multiplication of particulars that a satisfactory theory will be suggested. If we can find a theory that will fit all the facts here enumerated, we shall have probably a satisfactory theory for all observed facts, and one that will prove helpful in directing our further study of this most important process.

CHAPTER IV.

THE HYPOTHESIS.

The nature of the hypothesis that will accord with all the facts recognized as significant, must be already evident. When we bring into juxtaposition two such facts as that the rate of transmission of a nervous impulse is from twelve to twenty times as great through a nerve as through a brain center and that feeling is experienced only when an impulse is passing through a brain center, we are led to inquire if the slowness of the rate of transmission is not in some way associated with the establishment of the feeling. When we bring into juxtaposition two other facts, that practice decreases reaction time and that feeling tends to disappear from an habitual act, we shall have our previous supposition confirmed. In all of our significant data, we shall be able to see that there is some kind of a relation between the slowness of transmission and the intensity of feeling. We have called that condition which contributes to the retarding of a nervous impulse, and the consequent lengthening of reaction time, resistance. We shall be ready then, at once to state as a tentative working hypothesis, that feeling is the concomitant of the resistance which a nervous impulse encounters in passing through a nervous arc.

The evidence that there is resistance to the transmission of a nervous impulse is found principally in the fact of the slow rate of reaction time, and the more rapid rate of transmission in a nerve fiber than in a brain center. There will be little question in the mind of any one who recognizes that a nervous current is transmitted, that this current meets with resistance. The resistance has

been recognized by almost every physiologist and psychologist who has given thought to the matter, and reference has already been made to such recognition. Höffding, quoting Richet says, (*Psychology*, p. 223) that "Pain without memory and without radiation would be no pain at all. It is thus not of so simple nature as sensation. It probably presupposes the subduing of a great resistance in the central nerve organs." And again, (p. 37) "The ganglion itself exercises an inhibitory influence upon the impulse, for as can be shown by experiment, the course of the nervous process is much slower in the brain and spinal cord than in the peripheral nerves." In Ziehen's *Physiological Psychology* we find the statement that "The sensation must have a certain intensity in order to overcome the resistance to conduction in the intercentral paths and to produce motor effects." So Ladd (*Outlines*, p. 174) remarks that "The nervous substance of the central organs offers a greater resistance to the progress of a nerve commotion than is offered by the nerver." Titchener, (*Outline*, p. 96) says "We know that nervous substance resists the incoming of stimulation. The resistance which it offers can be overcome only by stimuli of a certain strength." So Ribot, (*Emotions*, p. 84) says "When an excitation increases as we have seen, the number of muscular groups set into motion, resistance to transmission increases in the same proportion." And again, (p. 84) "The sensation of pain presupposes a reflex movement and an arrest of nervous conduction in the grey substance of the spinal marrow. It is this process of inhibition in varying degrees that is felt by the consciousness as pain."

It is necessary for us to have a clear understanding of what we shall mean by resistance, for by it we shall expect to explain and make clear many divergent, obscure, and apparently contradictory phenomena. We are using the word resistance in a slightly modified sense

from that in which it is employed in describing the phenomena of an electric current. As the term is used in electricity, it means the property of a conductor that tends to destroy or diminish the amount of current that passes through it. It is always considered as a property of the conductor, and its amount is measured in ohms. The effect of the resistance placed in a circuit is to diminish the amount of electricity that is passing through the circuit, but there is a cumulative effect manifested in the heating of the wire that furnishes the resistance. With a current of a given electro-motive force, the amount of electricity that passes through the wire will vary inversely as the resistance. With a given quantity of electricity passing through the wire, the heating effect will vary directly as the resistance.

When we use the term resistance in discussing the nervous current, we shall need to modify our conception of it somewhat. We shall consider resistance as not merely a property of the conducting nervous arc, but it will be measured by the amount of current which is destroyed. It will be seen that this definition is intended to cover two elements; first, the nature of the nervous arc, and second, the strength of the current. Resistance, then, in the sense in which it is proposed to use the term, depends upon two factors, both variables, and varying independently of each other. One is the nature of the nervous arc, and the other is the strength of the current.

It will be seen that when we use the term resistance to mean the resultant of the two elements described, we may consider the concomitants of both the two as more nearly corresponding to the heating effect produced by the current of electricity. As the heating effect produced by the electric current depends not only upon the number of ohms resistance in the circuit, but also upon the electro-motive force and the amount of the current, so the resistance in the nervous arc will depend upon the strength

of the current, as well as upon the nature of the nervous arc.

The effect of the resistance is to diminish the quantity of energy that succeeds in passing through the nervous arc. If the nervous energy is increased, the quantity of energy that succeeds in overcoming the resistance offered by the nervous arc is greater, but a larger quantity is stopped out by the resistance in the arc itself. If we consider that quantity of nervous energy that is stopped out as the concomitant of feeling, we shall have a clear understanding of what is meant by resistance. The resistance varies as the quantity of nervous energy that is stopped out or destroyed by the arc.

We may state some of the laws of resistance in the following manner. With a current of a given strength, resistance will vary with the nervous arc through which it is transmitted. The resisting power of any particular nervous arc will be modified by various circumstances. In the first place, repeated transmission of an impulse through the arc will diminish its resisting power. This is sometimes called the law of neural habit, and is one of the best known laws of nervous action. Its explanation is to be sought in the manner in which the molecular structure is restored after its equilibrium has been destroyed by the removal of atoms in the transmission of an impulse. We have here an opportunity to explain the way in which a habit is formed, and an insight into its neurological basis.

But it is not merely the number of repetitions of an impulse through a nervous arc that decreases its resistance. The resistance in the arc will be modified more rapidly by a strong nervous impulse than it will by a weak one. A smaller number of repetitions of a strong nervous current will modify the resistance of the arc as much as a larger number of weak impulses.

The resisting power of a nervous arc will be modified

not only by practice or habit, but by the blood supply at any particular time and the general pathological conditions of the nerve tissues. In cases of inflammation of the nerve tissue, or when it is acted upon by different kinds of drugs, such as chloroform, the resisting power of any given nervous arc to a current of given strength may be modified.

A third method by which the resisting power of any given nervous arc may be modified is through the process of attention, whose discussion must be reserved for a subsequent chapter.

A second law of resistance may be stated as follows:— In a given nervous arc, the amount of resistance encountered will vary directly with the strength of the current. In the statement of this law, it is not intended to give an exact mathematical expression of the relation between resistance encountered and current strength. It may be that the resistance will vary with the square, or some other function of the current strength. We have no means as yet of measuring the strength of a nervous current, nor has any unit been established for it; consequently, we have no means of measuring the amount of resistance offered by a nervous arc and no unit for it. It is, therefore, impossible to assert with any degree of confidence, what is the function that expresses the ratio of variation. But the problem of measuring the strength of the current and the amount of resistance is not at all hopeless. Neither have we any means of measuring the intensity of feeling, but we know that feelings vary in intensity. The problem of the future is to establish a unit for different psychological processes, and to devise means of measuring their intensity.

As a consequence of our second law, we understand that if a current is feeble and weak, little resistance will be encountered in passing through a nervous arc, and there will be little modification of the arc by it. If a

current is strong, great resistance will be encountered, and much modification of the arc will result.

There can be no question that nervous currents do vary widely in strength. The strength of the current at any time is dependent, in some degree at least, upon the amount of nervous tissue that is oxidized. Blood supply, plenty of food, pure air, sufficient exercise to quicken the heart beat and send the blood rapidly to the brain, are all conditions that tend to increase the amount of tissue oxidized, and the amount of energy liberated. Narcotic drugs tend to diminish the amount of oxidation of tissue, to weaken the strength of the current, to diminish resistance and to deaden feeling.

We can readily recognize the fact, also, that a peripherally initiated impulse, which starts in some end organ of sense is in general stronger than a centrally initiated one. The force that originates the peripherally initiated impulse is generally greater than the force that originates a centrally initiated impulse. The external forces that act upon sense organs are sufficiently large, in many cases at least, to be measurable by physical means, while whatever the force may be that originates the centrally initiated impulse, it is scarcely likely to be measurable by any means that we now employ in our laboratories. It is even possible to measure the pressure of light, which was believed for so many years to be absolutely lacking, but it is scarcely possible to measure the force that can decompose a molecule of protagon and deprive it of a small number of its atoms.

It is very possible, too, that the end organs of senses are devices for multiplying the effects of the sensible forces, which is not likely to be true of the central cerebral organs. Both of these considerations enable us to understand why the peripherally initiated impulses are stronger than centrally initiated ones.

Concerning the nature of the resistance, we are able to

say not much that is definite. We know little about it, but we know perhaps still less about the nature of the resistance in the case of an electric current. Why should an iron wire offer greater resistance to the passage of an electric current than does a copper wire of the same length and diameter? What is the property of iron or copper that makes it offer resistance? To such questions we can give no answer at all, and yet we are enabled to measure this resistance in the different wires with great accuracy.

So there can be no question concerning the fact that there is resistance encountered in a nervous arc. Concerning its nature, we are almost as much in the dark as we are in the case of the electric current. Although we shall use again and again the analogy of the electric current, we must carefully discriminate the two, for an electric current is not a nervous current, nor is a nervous current one of electricity. That idea was abandoned almost as soon as it was suggested, fifty years ago.

If we adopt the view of the nature of a nervous current that was suggested in Chapter III, we may have a means of understanding something about the nature of the resistance. Let us assume that the nervous current consists of a change in successive molecules and that this change involves the transmission of one or more atoms from one molecule to the next. The strength of the current will be measured by the number of atoms that are transferred, and the probability, judging from the structure of the molecule, is that the same number will be transferred between every pair of molecules. This will show us why it is that in case of a peripherally initiated impulse, the stronger stimulus will generate the greater current and correspond to a sensation of greater intensity. The atoms are not likely to be released with equal facility, but the first one to go will be the one that is held least strongly in the combination. The second one will demand a greater force to jar it loose, and the third will

take more than the second. Hence it is that equal increments of stimulus will not correspond to equal increments in current strength, and we have an explanation in physiological terms, of Weber's law. James has already foreseen this explanation when he says (*Psychology*, vol. I, p. 548) "If our feelings resulted from a condition of the nervous molecules which it grew ever more difficult for the stimulus to increase, our feelings would grow at a slower rate than the stimulus itself. An ever larger part of the latter's work would go to overcoming the resistances, and an ever smaller part to the realization of the feeling-bringing state. Weber's law would thus be a sort of law of friction in the neural machine." In this quotation the word feeling is used in a different sense from that which is employed in this book, but the principle of resistance is well expressed.

There will be little difficulty in understanding that the amount of resistance encountered in one molecule or in one cell will be very slight compared with that which is encountered when an atom is compelled to pass from a molecule of one cell to a molecule of another cell. While it is true that some kind of force must be expended in doing the internal work of a molecule, rearranging its atoms to produce the change from a colloidal to a crystalloidal state, the change is slight compared with that required to transmit an atom from one cell to another through the intervening space.

In order that there may be a current, the nervous impulse must be prevented from leaving the conductor and spreading out indiscriminately over the brain tissue. The analogy of the electric current will help us here. The conductor of electricity must be insulated to prevent the current from leaving it, and the conductor of a nervous current must also be insulated. In the case of a nerve, the medullary sheath probably serves as the insulator. Evidence of this proposition may be found in the fact that

until the nerves become medullated they are non-functional, and medullation is considered a symptom of functional capacity. Also we must recall that the medullary sheath disappears at the extremity of the nerve fiber, which is the place at which the current leaves the fiber to pass its influence on into the organ with which it is connected. The medullary sheath is also absent from the origin of the nerve fiber, but at this place the cell from which it springs is surrounded with neuroglia. While some writers have supposed that the function of the medullary sheath is largely nutritive, the evidence seems to be strong that insulation is an important part of it.

The molecules that constitute the axis cylinder of the nerve fiber are in physiological contact with each other. It is not necessary to suppose that they are in physical contact, but their distances from each other are molecular in extent and an atom flying off from one can easily pass directly to another. In this structure we have an explanation of the comparatively rapid rate of transmission of the impulse in a nerve.

But the cells of the brain, the neurons, are not in physiological contact with each other. They are embedded in neuroglia, which furnishes them a support, and a kind of packing material, isolating one cell from another, and serving as an insulator. It may be that the neuroglia has also a nutritive, as well as other functions, but it seems extremely probable that the insulating function is the most important that it has. The tips of the dendrites and the terminal arborizations of the dendrites and the axons in the brain in no case come into direct physical contact with each other, and are separated by such distances that they are, under ordinary circumstances, not even in physiological contact. The transmission of an impulse through a brain center from one neuron to another is mediated by the neuroglia, through a small layer of which, sometimes called the synaptic

membrane, it must go when an impulse passes from one neuron to another. The flying atoms or corpuscles must pass through it, and it seems as if in this fact we have an explanation of the resistance that is encountered, and the reason why the rate of transmission is slower in the brain center than it is in the axis cylinder of the nerve fiber.

If this hypothesis is capable of demonstration, we have grounds for another speculation which is closely accordant with the latest and best observations that have been made. That is, that the concomitant of the feeling process, as well as of any other mental process, is the change that occurs at the tips of the dendrites, or just at the place, called the synapse, where the transfer of an impulse from one cell to another occurs, rather than as is ordinarily supposed, in the cell body itself. Thus Morat, (*Physiology of the Nervous System*, p. 26) says: "It seems indeed that it is here [at the point of junction of the neurons] that the principal transformations which the impulse undergoes in passing through the gray matter, take place. Fundamentally, what is described as a center is merely a locality where the neurons are able to organize themselves into a definite system (partial) in order to perform a definite function." It is probable that the cell body is the location rather of the nutritive function of the cell, and of the katabolic processes of oxidation by which the nervous energy is liberated, than of the process which is the concomitant of the mental function. The expression which is a favorite one with some writers, that in the cell impressions are stored, is one whose use is much to be regretted.

We have then, in the neuron, two distinct functions, whose concomitants it is necessary to differentiate clearly. We shall have occasion to refer to the two differing functions in discussing the process of attention and the esthetic feeling. For psychology, the one is as important as the other, but they manifest themselves in different

ways. Not only is the function of the cell body a nutritive one, but in it is located also that process which renders the nutritive function necessary, and without which it would be useless. The katabolic processes go on in the cell at an equal rate with the anabolic. But the katabolic processes liberate energy which is the property upon which the strength of the nervous current depends. But all processes properly mental have their concomitants in the process involved in the transfer of the impulse from one cell to the other, which transfer occurs at the terminal arborizations of the axons and dendrites. The discrimination of these two functions of the neuron will help us to understand and to explain many things that otherwise would be mystifying or appear to be contradictory to our hypothesis.

It is our purpose next to inquire what reason we have for identifying this resistance with the concomitant of feeling. It will be difficult for us to adhere to our method of describing feeling and resistance as concomitants, for the temptation is great to consider feeling as a function of resistance, and caused by it. We speak of heat as the result of the resistance in the case of the electric current, and no harm is done. But in psychology, it is necessary to limit our statement of the relation merely to that of concomitance. If we could employ the word function in the mathematical sense, without danger of being misunderstood, we should have an accurate statement of the case without deviating from our doctrine of parallelism or correspondence.

The evidence that feeling is the concomitant of resistance depends largely upon the facts of concomitant variation. Wherever we are able to demonstrate increased resistance, we are able to perceive an increase in feeling. Wherever we are able to show that resistance has been diminished, we observe a corresponding decrease in feeling. This is especially noticeable in habit and in case of

narcotics. Such a theory will also enable us to explain why it is so very difficult to remember, recall, reinstate a feeling. We may remember that we have experienced a feeling, and may even reinstate it in a mild way, but the reinstated or remembered feeling is much fainter in every respect than was the feeling accompanying the original experience. We have but to recognize the fact that a centrally initiated impulse is weaker than a peripherally initiated one and therefore encounters less resistance, in order to understand why it is so difficult to reinstate a feeling, and why remembered feelings are less vivid than are the feelings accompanying the original experience.

But the strongest evidence of the truth of this hypothesis will be found in its general conformity to every fact of feeling that we know. It must be proved, as any other hypothesis must, by its ability to explain the facts that are known, associating them under one principle, and to be contradicted by none. Also, if it enables us to predict facts that are as yet undiscovered, and then we are able to verify our prediction by discovering the facts, we shall have decidedly convincing evidence of the truth of the hypothesis. All of these things it is possible to do by means of this theory. The larger part of the remainder of this book will be devoted to a discussion of the facts of feeling which find their explanation only in some hypothesis such as this.

We have seen that there is indubitable evidence of a delay in the transmission of a nervous impulse through a brain center, while there is not so great delay in the transmission through a reflex arc. We have accounted for this delay in transmission through the brain center by the fact that the nervous impulse encounters resistance. Here, then, we have a difference and a means of distinguishing between the nervous impulse that is accompanied by a mental process and a reflex that is not. Hence we are compelled to recognize that this delay, hesitation, resist-

ance in the brain center is a concomitant of every kind of mental process. If it were not for this delay, we should have no kind of a mental process except that which is involved in a reflex act. It is scarcely too much to say that all of our mental processes are associated with this delay arising out of resistance. Perception, judgment, attention, reasoning, feeling, consciousness, memory, will,—all of these mental processes find their concomitants in the physiological processes involved in this delay. This is the interpretation that we may put upon Mr. Spencer's statement that all mental processes arise out of feeling.

If all mental processes have their concomitants in some feature of this delay, why do we single out feeling as the concomitant of the resistance itself? Why is not resistance the concomitant of cognition, attention, or consciousness?

It will be observed that in the statement of the hypothesis we have used the term resistance in a very technical sense, comparable to the use that is made of it in case of an electric current. There are various elements of a current, such as driving force, field of influence, work done, methods of directing it, resistance, etc. No current can exist without all of them. Every current not only encounters some resistance but it must have a conductor, there must be some driving force, it is capable of doing some work, it is directed by various means, it exercises some influence upon the surrounding space or upon objects that are near. Resistance is only one of these elements, and it is the only one of them that can be considered as the concomitant of feeling, and used to explain its phenomena. If we undertake to associate the phenomena of cognition, or intellect, with the fact of resistance, we encounter insuperable difficulties. When the conditions of body and brain are such as to establish great resistance, and manifest a slow rate of transmission, the amount of feeling is increased but the amount

of intellectual work that we are capable of doing is not increased, but diminished. So when we test it by trying to explain the phenomena of memory, will, attention, or consciousness, we shall find corresponding difficulties. Resistance seems to be the only element of the nervous current that varies concomitantly with feeling, and every phenomena of feeling finds its appropriate explanation in resistance. From this fact we determine the concomitance between resistance and feeling. We shall discover that each of the other elements of the nervous current has its appropriate mental concomitant. So while the delay arising out of resistance is necessary to the establishing of every process called mental, it is the resistance in a technical sense that must be described as the concomitant of feeling.

We have tried to avoid a form of statement that would imply a causal connection between the resistance and feeling. But the question naturally arises: "What is the connection between feeling and resistance?" We are as utterly unable to answer this question as we are to answer any other question that demands a statement of the ultimate relation between mind and body. Why we should experience any kind of a mental process when a nervous impulse traverses one brain center, and another kind of a process when an impulse traverses a different brain center, is equally unknown. Why we should experience much feeling when much resistance is encountered in the brain center, and little feeling when the resistance is small, is merely another form of putting the same inscrutable question. We may accept it as a fact in the same way that we accept any other ultimate fact. We are no less able to answer one of these questions than we are to answer the question why copper conducts electricity, or why a body unsupported falls to the ground. We can associate the phenomena of mental life with other processes that have been developed through the ages by

the process of natural selection working upon fortuitous variation, and transmitted by heredity. The nervous system seems to have been developed in such a way that those individuals in whom resistance in the brain center was accompanied by feeling have had the best chance for survival, and have left the larger number of descendants. So far as this is any explanation we may adopt it. Beyond this point we are unable to go.

SYNOPSIS.

1—*Feeling is the concomitant of the resistance which a nervous current encounters in passing through a nervous arc.*

2—*Nearly all psychologists have recognized the fact that a nervous impulse encounters resistance.*

3—*Resistance depends upon two factors; the nature of the nervous arc and the strength of the current. This fact necessitates the postulation of two laws for resistance, and two laws for feeling.*

4—*While all mental processes are associated with the delay in transmission, it is only feeling that can be described as the concomitant of resistance.*

5—*The general evidence of the truth of the hypothesis is to be found in the facts of concomitant variation, and in the possibility of explaining every fact of feeling by means of it.*

CHAPTER V.

THE EXPRESSION OF FEELING.

Whenever a feeling is experienced, it is accompanied by some muscular movement or glandular activity that is called its expression. The muscles of the face are particularly expressive muscles, although perhaps a very large part of their expressiveness comes from the fact that the face is most commonly exposed to view, and we have, therefore, learned to interpret the facial movements better than the movements of any other part of the body. We can tell by the movements that the facial muscles make, very nearly the kind of feeling that a person is experiencing. When we see the corners of the mouth drawn down, the forehead wrinkled, the eyebrows drawn together, we feel very confident that the immediate prospect does not appear to that individual in the most roseate colors. If we observe the corners of the mouth elevated, the eyelids raised rather more than usual, the chin lifted, we know that the outlook is not such as to plunge him into the depths of despair. So the facial muscles are capable of expressing emotions of the most bewildering variety.

We have had so much opportunity for observing the expression of emotion upon a person's face, that we have become exceedingly skillful in interpreting the most minute indications of it. The amount of movement which it is necessary for the facial muscles to make in order for us to recognize a change in the feeling experienced, is so exceedingly small as to be almost incalculable. The combined action of several muscles each in an exceedingly small degree, produces such an amazing complexity of ex-

pression that it is almost impossible to analyze a single one out of the great number, and yet, as a result of long experience in observing them, we readily recognize each.

We are so much accustomed to judging of a person's feelings by the movement of the facial muscles, that we almost forget that other muscles are as truly expressive as are the muscles of the face. It is universally known that the heart beats differently when we are experiencing one kind of feeling from what it does when we are experiencing another kind. The rate of beating, and the vigor of the stroke are correlative to the appropriate kind of feeling. The muscles that are employed in breathing also modify their activity when we are experiencing different kinds of feeling. If our feelings are such as have a painful tone, the action of the diaphragm and the intercostal muscles is likely to be such as to diminish the amount of air that enters the lungs at one inspiration, while if the feeling experienced has a pleasurable tone the inspiration is likely to be deeper and fuller. The muscles that move the visceral organs also act in a different way when we are experiencing one kind of feeling from that in which they move when we are experiencing another kind. The muscles that control the dimensions of the arteries and the smaller bloodvessels respond to the influences associated with the different kinds of feelings, and produce the changes of blushing and pallor, a strictly muscular expression. So we recognize that the facial muscles, the respiratory muscles, the visceral muscles, the circulatory muscles, and the heart are all muscles expressive of feeling.

Not merely the muscles that move these different internal organs express feeling, but also the larger muscles that control the legs and arms, the head and the entire body are equally expressive. We understand the state of feeling of a person perhaps as well by the movement of the hands, the way he jerks his head, the nervous tapping of

the foot, as by the expression of the face itself. The very attitude of the body expresses confidence, fear, apprehension, or any other feeling. By the attitude of his body when he is walking along the street, we can judge of a person's frame of mind, and something of the feelings that he is experiencing. The erect carriage, firm tread, head up, shoulders back, express a state of mind that is easily recognized without even a glimpse of the face, while the stooping posture, drooping shoulders, hanging head, and slow, hesitating movement of the feet in walking indicate a feeling of a very different kind. We can tell that a man is angry if we see no more than his back when he is walking away from us. We say that he is mad clear through. The muscles that control the movement and attitude of the body are as truly expressive as are the muscles of the face.

Not merely the voluntary muscles that are often called into action express feeling, but some muscles that are vestigial and no longer have any function in the ordinary movements are expressive. The little muscle at the root of each hair in the scalp is a vestigial muscle which in some cases of extreme fright is stimulated to contraction, tending to cause the hair to stand erect upon the head.

The expression of feeling is not limited, however, to the movement of muscles. It is a most common observation that children weep, shedding tears when they are experiencing a strong feeling of grief or anger. The lachrymal glands secrete more abundantly when grief is experienced than when it is not. So the contemplation of a luscious watermelon or other particularly attractive articles of food is likely to establish such a feeling that, as we say, "our mouths water." The salivary glands secrete their proper fluid in greater abundance when we are experiencing the feeling that accompanies the sight of a much desired article of food. When we are badly frightened, a cold sweat breaks out. The sudoriparous glands secrete

more abundantly than usual when we are experiencing the feeling of intense fear. The ordinary stimulus for the secretion of perspiration is heat, but in the case of cold sweat, the stimulus is not heat, but a nervous impulse is directed to the glands by some other means, and the sweat instead of being hot, as is usually the case, is cold.

Glandular secretion, then, is another expression of feeling, and there is little doubt that under the stimulus of an appropriate feeling, almost any gland in the body may be caused to secrete so that its activity would properly be an expression of the feelings. Glands are like muscles in the fact that their secretion is determined by the stimulation of a nervous impulse. If any gland were to be deprived of its nervous connection, and an impulse fail to run out to it, the function of the gland would be at once destroyed. The gland secretes and the muscle contracts when a nervous impulse runs out to it, and if no impulse reaches either the gland or the muscle the function of that organ is not accomplished. Any really valid explanation of the expression of feeling must explain how it is that a nervous impulse runs out to the expressive organ.

Occasionally the paralysis of a gland or a muscle is an expression of feeling. In cases of great fear, some persons are paralyzed and incapable of moving. It is said that in a method of criminal trial in India, the suspected person is compelled to eat a rice cake. It is presumed that if he is guilty, he cannot swallow the cake, while if he is not, then no difficulty is experienced in eating it. The explanation is that when a person who knows he is guilty is put on trial, he is so affected that the salivary glands are paralyzed, failing to secrete saliva, and the cake is ground into a dry powder which cannot be swallowed. The innocent person is not so affected and, not experiencing the same kind of feeling, his salivary glands are not paralyzed, and no difficulty is encountered in eating the cake.

In some instances a nervous impulse carried to a muscle inhibits its activity. An impulse carried to the heart along the vagus nerve causes the beating of the heart to cease. Similarly, stimulation of certain centers in the medulla from which impulses lead to the respiratory muscles, inhibits their activity. So we may readily understand that if an impulse is sent along the proper nerve to a gland or to a muscle, its appropriate activity will be checked, or temporarily destroyed. Either inhibition or activity of gland or muscle may constitute an expression of feeling. In order that the inhibition may constitute expression, however, it must be the result of a nervous impulse reaching the gland or muscle along the proper inhibitory nerve. The essential feature of the expression is an impulse running out to the organ whose activity is recognized by us as an expression.

It is in the expression of feelings that the James' theory differs most widely from the common theory. The common theory asserts that the feeling is experienced first and the expression follows; the feeling is the cause of the expression. In this common theory, no plausible reason can be given for the expression. The feeling is the same whether it is expressed or not, and the expression seems to have no use except perhaps as a means of communication. It is even supposed by some psychologists that the mobility of the facial features is part of a design for rendering expression possible, and some features and some muscles find their only function in expressive movements.

In the James theory, the expression causes the feeling. Without the expression, there is no feeling. The principal difference, then, is in the order of the feeling and the expression.

If we interpret expression in terms of the resistance theory, we shall see that expressive movements arise as a consequence of the resistance that a nervous impulse encounters in passing through a nervous arc. Whenever a

current encounters resistance, it follows the path in which the least resistance is encountered. Any kind of current, water, electricity, or nervous, will have its path determined by the resistance it meets. The amount of current that goes over two conductors extending between the same two points is inversely proportional to the relative amounts of resistance offered by each.

In this respect a nervous current is similar to any other. It will spread out into the direction in which the least resistance is offered. The resistance of a brain center, as we have seen in a previous chapter, is capable of being modified by at least three circumstances: habit, attention, and natural constitution or heredity.

The fact that a nervous impulse radiates out of the brain center through which it is passing, and in which it is the concomitant of a particular kind of feeling, is recognized by many psychologists. Baldwin says: "In adult life, also, very intense stimulations cannot be held within their ordinary channels, but become diffused through many courses. Note the contortions of the man undergoing torture at the hands of a dentist." (*Handbook*, II, p. 296.) Spencer remarks: "That every special pleasure or pain does produce a peripheral or central diffused effect is clear. . . . Much more then, does it spread through those more directly related parts of the nervous system which are the seats of conscious action." (*Psychology*, I, p. 599.) So Darwin has stated that "when the sensorium is strongly excited, nerve force is generated in excess, and is transmitted in certain definite directions, depending upon the connection of the nerve cells and partly upon habit." (*Emotions*, p. 29.) Again quoting Darwin: "The radiation of nerve force from strongly excited nerve cells to other connected nerve cells may help us to understand how some reflex actions originated." (p. 41.) And again: "On the principle of radiation of

nerve force to adjoining cells, the lachrymal glands would be stimulated." (p. 170.)

Admitting this principle, that when resistance to the transmission of a nervous impulse through a brain center is encountered, the nervous energy tends to flow over into the other centers where it encounters least resistance, we have an easy explanation of the expression of feeling. The resistance itself is the concomitant of feeling, but the resistance that is encountered causes the nervous impulse to flow out into other centers than those directly involved in the path of the current. It tends to overflow, radiate, spread out into other portions of the brain than that which constitutes the nervous arc itself. When this nervous current, driven by the force behind it, and meeting with resistance in front, spreads out, it runs into those portions of the brain in the direction in which the least resistance is encountered.

For the sake of avoiding circumlocution in the rest of this explanation, let us call the combination of cells which is traversed by an impulse when a particular feeling is experienced, the feeling center; and the combination of cells into which the nervous impulse runs when a muscular or glandular action that constitutes the expression of that particular feeling occurs, the expression center. In this way, we may use short, definite, and clear expressions without danger of being misunderstood.

The expressions of feeling most easily observed are these muscular movements. It becomes necessary to inquire why it is that this energy that escapes from the feeling center should run into the motor centers rather than into other portions of the brain. The motor areas are those that are the earliest organized. They are the centers whose functions are among the most necessary to the preservation of the life of the individual. They have from the first been connected closely with the operations of the other centers; such as the sight center, hearing, touch,

taste, smell, and muscular sensation; and the connection between the motor centers and other centers is very likely to be closer and more frequently traversed by impulses than is the connection between any other two kinds of centers, as for instance, between sight and hearing. Hence we should expect to find that in case of overflow of nervous energy from one center, or combination of cells, the radiating impulse would meet with less resistance in flowing into some motor center than in flowing into any other kind.

When we take into account, also, that the motor area lies along the fissure of Rolando directly in the middle of the brain, we shall see that the passage into the motor area from almost any other portion of the brain is likely to be rendered very easy. Hence we shall expect to find that the resistance in a center sufficient to constitute the concomitant of any kind of feeling, is likely to be followed by some kind of a muscular movement.

Whatever may be said of muscular movement as a form of expression, may be affirmed with less facility of demonstration, of glandular activity.

It is doubtful if the expression of feeling is really limited to glandular secretion and muscular movement. On this principle of the expression as resulting from the overflow of nervous energy, the activity of any brain center that results from the overflow would constitute an expression of feeling. It is likely that many kinds of mental processes, each of a very moderate degree of intensity, that occur at the same time as the principal process, ought properly to be explained as expression of feeling. This is particularly true of consciousness, and constitutes the best possible explanation of the close relation between consciousness and feeling. Sometimes when a person becomes very angry, he sees red. This intellectual sensation, with many others that will probably be discovered of a

similar nature, properly constitutes an expression of feeling.

In this explanation of the expression, we have a means of understanding the relation between the feeling and the movement that expresses it. The feeling is not the cause of the expression, as the common theory would assert, nor is the expression the cause of the feeling, as the James theory would affirm; but both feeling and expression arise out of the same circumstance, the resistance that is encountered by the nervous impulse in passing through a brain center. The expression does not precede the feeling, nor does the feeling precede the expression, but both feeling and expression arise at the same time, that being determined by the time that the resistance is encountered. The relation is one of concomitance and direct relation, and not of sequence nor causality.

We have also in this explanation a means of understanding the relation between the intensity of feeling and the magnitude of the expression. Since both are conditioned by the amount of resistance encountered, we can be logical only by asserting that the greater the resistance, the greater will be both the feeling and the expression. Since both feeling and expression vary with the resistance, they will vary with each other. Both will vary directly as the resistance encountered and as the resistance increases, so will both feeling and expression increase. In case of much feeling, not only the muscle that is usually considered the expressive muscle for that feeling will contract, but many muscles not considered expressive of that feeling at all will be thrown into contraction. This is the case referred to by Baldwin in the quotation about the man writhing in the dentist's chair. The overflow of energy escapes into the whole motor area, and every muscle in the body may be caused to contract in various degrees by this influx. A feeling of smaller degree of intensity will be an accompaniment of less overflow, and only

those centers most easy of access will receive an appreciable quantity of it.

We are now in position to demonstrate the true theory of the relation between the inhibition of the expression and the decrease of feeling. The James theory offers as one of its lines of evidence the fact that the inhibition of the expression inhibits the feeling. While we have already observed that in some cases this is known to be directly contrary to fact, in other cases it appears to be true. The resistance theory of feeling will enable us to bring into harmony the observations that appear to be directly contradictory.

It has already been observed that the inhibition of certain muscular activities, as in the case of paralysis from fear and the failure of some very ordinary glandular secretions, in itself constitutes the expression of the feeling. In order to inhibit such an expression we shall have to inhibit the inhibition, which is not, however, a paradox nor a contradiction in terms.

In cases where the inhibition is a true expression, the nervous energy may be conceived to overflow into some center that is connected with the organ whose function is inhibited by a nerve similar to that of the vagus nerve of the heart. Here the inhibition is an expression, not really a process that comes within the limits of the evidence offered by Mr. James.

In many cases we mean by inhibition the substitution of one mental process in which the feeling is much lessened for another in which the feeling element is greater. "When angry, count ten; when very angry, count a hundred," said Jefferson. But when we are angry, we are contemplating a situation that may be very complex, involving many different elements, and the nervous impulse which is transmitted through all these combinations of brain cells is encountering much resistance. When we stop and count ten, we are directing the nervous impulse

through a totally different combination, drawing off the nervous current from the combination in which resistance is encountered into another in which little resistance occurs. We thus diminish very much the intensity of the current running through the first combination, lessening the amount of resistance, and producing a lessened feeling.

This is a very common example, and the type of illustrations that is commonly used as evidence of Mr. James's proposition that inhibiting the expression inhibits the feeling. It is not strictly in point, and does not serve directly the argument of Mr. James. How is it that a direct inhibition of the expression, without any substitution, may diminish the feeling?

We have seen that one of the ways in which the amount of resistance may be decreased is by a process of attention. The explanation of the mechanism of this process must be deferred to a subsequent chapter, but we may accept it on faith for the present. Attention is a process by means of which nervous currents are directed into and through a brain center. The only mechanism by means of which the nervous impulse may be directed is one in which the resistance is varied, being increased in some directions and decreased in others. If by a process of attention, we are able to diminish the resistance that the nervous impulse encounters in passing through a brain center, we shall lessen its tendency to overflow out of the brain center, and diminish the amount of energy that escapes from the brain center into the expressive organs. This effect may be brought about without lessening the amount of intellectual work that may be accomplished by it. When we diminish the expression by means of lessening the resistance in the brain center, the same process diminishes the feeling.

This explanation seems in every way understandable and explains the diminished feeling more satisfactorily than does the James theory. When we inhibit the expression in this manner, we describe it by saying that we

have reasoned ourselves out of the feeling. But let us examine cases such as every one has himself experienced, and which seem to contradict directly the proposition of Mr. James.—These cases have been noted by Höfding, quoted before: "The concealment of a feeling may cause it to penetrate deeper into the nature of the individual." (*Psychology*, p. 332.) In a good many cases, it seems as if the expression of feeling is one of the best means of diminishing its intensity; bottling it up merely increases it. The comfort of a "good cry" to many women is something not to be denied. Not to cry, to inhibit the expression, has no effect in diminishing the feeling.

Attention directs the nervous impulse by varying the resistance between cells and centers. It may increase the resistance in one place, and diminish it in another. If we suppose that we increase the resistance between the feeling center and the expression center, without decreasing the resistance between the cells in the feeling center itself, we shall have inhibited the expression without inhibiting the feeling. While this may not be the usual action of attention, it will explain the results observed in the unusual cases. The inhibition of the expression without inhibiting the feeling is an unusual procedure at the best, but it does occur many times and every one has experienced it.

Still another series of phenomena needs to be explained. The James theory asserts that giving expression to the feeling induces the feeling itself. While we have already seen that this is not universally true, that many times the expression of feeling may be observed without the feeling being experienced, that there is no causal connection between the expression and the feeling, still there are cases in which it seems to be true. How shall we explain the examples in which the feeling seems to be engendered as a result of the expression?

When we give expression to a feeling, a nervous impulse is traversing the expression center. If it is a true

expression, the impulse has entered the expression center from the feeling center. But we may direct a nervous impulse into the expression center by an act of attention, without its having come from the feeling center, and we have the expression without the feeling. But we must suppose that the connection between the feeling center and the expression center is a very close one, with little resistance encountered by a nervous impulse in going from one to the other. If a nervous impulse is traversing the expression center it will easily flow over into the feeling center. If the amount of nervous impulse is great enough to encounter considerable resistance in the feeling center, the feeling will be experienced; moreover it will become greater as the amount of current that enters the feeling center is increased and as the resistance in the center becomes greater.

There is one consideration that seems to conflict with this explanation. We have assumed that the impulse will flow as readily from the expression center into the feeling center as it will from the feeling center into the expression center. Some observations seem to show that the nervous impulse always flows one way, not both. It is believed that the nervous impulse always enters the neuron by means of a dendrite, and leaves it by an axon. Without detracting from the accuracy of the observations from which this deduction is made, we may question the universality of the conclusion. The observations from which the conclusion is drawn are made upon the ganglion cells in the spinal cord, and not in the brain. The spinal nerves and ganglia have never been called upon to transmit impulses in more than one way, their function does not demand it nor permit it, and when the experiment is made, the function of transmission in the unusual way is similar to that in an undeveloped cell. But in the brain, impulses have been transmitted in all ways throughout the life of the indi-

vidual, and we are scarcely justified in admitting that the impulse will not go in either direction.

In fact, it is demonstrable that the impulse will pass readily between two centers in either way. The sight of a bell will call up the sound of it, and the sound will call up its image. Hundreds of examples of this kind will show that the process is reversible, for the association of the auditory and visual images demand that a nervous impulse pass either way from one center to the other. But even if it is demonstrable that in a particular cell the impulse will pass in only one way, it still remains true that the impulse does pass both ways between combinations. The impulse may travel a different path in going from B to A from that which it travels in going from A to B, but practically the effect is the same as if the two paths were identical.

It is now necessary for us to consider the question why certain feelings have the particular forms of expression that they do. Why should the one muscle contract when resistance is encountered in one brain center, and a different muscle, when resistance is encountered in another? The final and all-sufficient answer to explain the present expression is that the resistance between the two centers, the feeling center and its expression center, is less than it is between the feeling center and any other. But this is no explanation, and we still need to answer the question why it is that the resistance between these two centers is less than it is between the feeling center and any other.

In some cases, habit may be sufficient to account for the diminished resistance between centers. A person who has from any cause contracted a habit of swearing as an expression of anger or vexation, will almost unconsciously swear when any such feeling is experienced. So the pounding of the table as an expression of feeling may become such a habit that it unconsciously occurs when the feeling is experienced. Habit has resulted in rendering the transmission between feeling center and expression

center easy. While this explanation fails to consider how or why the action was originally adopted as a form of expression, it does explain how it comes to be merely a form of expression and meaningless as anything else.

In many cases, the expression is some kind of an action that is now, or was in some former situation, useful. This useful action accompanying a feeling gave its possessor an advantage in the struggle for existence. It came into operation by variation, was fixed by natural selection and transmitted by heredity. Mr. Darwin was the first who pointed out the advantage of many such expressions of feeling, and the list is constantly extending. Examples of advantageous expressive actions are found in the snarling of the dog, in which the lifting of the upper lip exposes the canine teeth rendering the animal ready for combat as well as warning a prospective antagonist of the preparedness of the dog. Mr. Darwin considers the wrinkling of the forehead and the drawing together of the eyebrows as another example of such expressions. It is an attempt to see farther and more clearly in situations where the seeing is difficult, such as those in which the sun is shining in the eyes. So any feeling of perplexity that is similar to that manifested in trying to see under disadvantageous circumstances is likely to be expressed in the same manner. It is evident that the same or closely connected brain centers must be involved in the production of feelings that have the same expression.

Children cry. The cry constitutes a very common and usual expression of pain. This expression is advantageous to the individual, for it is a demand by a helpless child upon a stronger person for assistance. This expression is so important that it is doubtful if the race would long survive if it were obliterated without some substitute replacing it. The crying is an expression whose nervous connection is already organized at birth. Hence it is that the movements involved partake of the nature of a reflex, and

as such it is possible to consider these movements not properly expressive of feeling, but purely reflex actions. It makes little difference how we consider it. The crying muscles are already closely connected with the centers in which resistance is encountered, and with a great many feeling centers.

Fear is a feeling having a painful tone, and it is of the greatest importance in preserving the lives of individuals. Not only is the feeling itself of importance, but equally so are its expressions. The expression of fear is not uniform, but changes with the character of the individual by whom the feeling is experienced. In a little child, or any other person accustomed to rely upon the assistance of others, the common expression of fear is a scream, which is a demand for assistance, and which frequently results in the escape of a child from a threatened danger. To run away from danger is an expression of fear found in less dependent classes of persons, which enables the individual to escape danger and to survive when, in many cases, to stand his ground would result in death. It is an advantageous expression.

A third expression, that is less common and expressive of the most intense fear, is fear paralysis. It is manifested sometimes in man, more frequently in children, but is best exemplified in those animals which have the habit of feigning death. The opossum affords a well-known example, not because it is the best, but because fear paralysis is an unusual characteristic in animals as highly organized as mammals. The habit is very common among beetles. Probably fifty species that manifest this expression have come under the writer's observation. While we cannot be assured that the feigning death is in beetles an expression of fear, the action is so similar to that of the opossum and of a man or a child that is paralyzed with fear, that we are inclined to attribute it to the same cause. This would

imply that beetles experience the feeling of fear, which would be very difficult to demonstrate.

Feigning death is an action sometimes extremely advantageous, and enables an animal to escape from a dangerous situation, especially if the danger arises from the threatened attack of some carnivorous animal. All kinds of animals perceive motion much more readily than they do color or form. An animal that remains perfectly motionless in any kind of a situation is more likely to escape observation than if a slight movement is made. Nothing else will keep an animal so still as a paralysis, and fear seems to be expressed by a special kind. In man, it is probable that this form of expression was formerly more advantageous than it is at present. Hence it was fixed by heredity in the organization of the nervous system, and persists as a kind of vestigial characteristic whose usefulness has largely disappeared.

We see, then, what is meant by an advantageous expression of feeling. In the instances cited, the advantage arises from the expression, but the feeling itself is advantageous to the individual. By the feeling the man is led to engage in some action which, although it can scarcely be called an expression, is directed by the intelligent judgment and leads to escape from danger, even though the method of escape has not resulted from the undirected overflow of the nervous energy out of the feeling center. The intelligent action indicates plasticity of nervous structure and involves attention. Feeling expression implies more or less fixity of nervous structure, and does not demand voluntary attention.

Many expressions of feeling that consist of glandular activity are advantageous. Not only can we discover a distinct advantage in the copious flow of tears in situations that produce painful feelings in the eyes, and an advantage in the secretion of the saliva when we contemplate food, but it has been demonstrated that in case of fear and

anger, certain glands, such as the adrenal glands, produce a secretion that is favorable to a stronger contraction of the muscles, enabling the person to fight more vigorously or to exert more muscular force in running away. It is probable that many expressions of feeling for which we can at present discover no use, did in times past have some function appropriate to situations that no longer arise. Hence they are vestigial functions, the key to whose explanation has been lost.

But there remains a large class of expressions that we are compelled to admit have no function at present, and certainly can have been of no advantage in any situation that we can conceive in the past. How shall we explain them? The suggestion occurs at once, since we find so many expressions that are advantageous, may not all expressions have had some use some time in the life history of the race? Mr. Darwin has stated a principle of anti-thesis, to which he attributed a more or less advantageous function, but it may be discarded completely as an explanation, and all expressions attributed to it placed in the unexplained class.

To attribute all expressions to the class that are described as advantageous, whether their present advantage is recognized or not, would be to assume that the course of development in expression was from the advantageous to the useless. The course of development has probably been exactly the other way. The resistance in the brain centers originally resulted in the overflow of the nervous energy into many expression centers indifferently, or into those centers offering the least resistance to entrance, and this differentiation of resistance was determined by causes so obscure that we may call it fortuitous. Many movements probably were expressive of the same feeling, just as at present intense feeling will manifest itself in many movements or in the contraction of many muscles. Some of these fortuitous movements proved advantageous, and were

selected and preserved, displacing as a principal expression all the others. Hence we recognize them today as the proper expression for the particular feeling. But it will not do to assume that a single movement constitutes the expression and no other movement could possibly do so. Not only such feelings as fear have more than one well recognized expression, but when we take into account the number of muscles that move, and the number of glands whose secretion is modified in connection with a strong feeling, we shall see that there are many movements that may be called the expression of a single feeling, and that every feeling, particularly if it becomes intense, may have numerous expressions.

SYNOPSIS.

1—*The expression of feeling is some kind of muscular or glandular activity which accompanies the feeling, and may be regarded as an evidence that such feeling is experienced. Inhibition of the activity of a muscle or gland may sometimes constitute an expression of feeling.*

2—*The expression is caused by the overflow of a nervous impulse out of the feeling center into the expression center. This overflow of the nervous energy is caused by the resistance encountered.*

3—*Many forms of expression are advantageous, but many others are fortuitous.*

CHAPTER VI.

THE PROPERTIES OF FEELING.

Feelings differ from each other in several respects, and the means by which we distinguish them we may call their properties. We may discover at least three properties of feelings by means of which they may be discriminated from each other.

Feelings differ from each other in their specific character, by which we mean that they are of different kinds. We may define the specific character of feeling by saying it is that property of feeling which we express by giving feelings different names. We do not mistake a feeling of fear for a feeling of pity, and a feeling of anger is specifically different from a feeling of love. While the long list of feelings that are described in books on psychology is of little value, and chiefly serviceable in a rhetorical way, no one will deny that feelings do differ specifically and that there may be many different kinds. No real explanation of the specific difference in feelings is given by any theory except the James theory, which asserts that the particular kind of feeling that is experienced depends upon the muscle which contracts to produce the movement called the expression, and whose contraction gives rise to the feeling. No theory of feeling can be considered satisfactory that does not explain why feelings differ in specific character.

It is impossible for us to understand the difference between feelings unless we recognize that no feeling is ever experienced except in conjunction with some intellectual process. That intellectual process is always a perception, either of some object or of a relation. Usually the feelings

are treated as if they were independent experiences, having only a remote relation to the intellectual processes. It is this failure of the new psychology in treating the feelings by its physiological and experimental methods to conceive the true relation between the feeling and the intellectual processes, that has rendered at all tolerable the theory that all kinds of pain are intellectual sensations. Such a determination of pain seems to be the first step in an attempt to reduce all feeling processes to an intellectual basis. It is in this field that we are most in need of some satisfactory theory of feeling. Much energy has already been unprofitably expended in consequence of the lack of such a theory, and the more promptly it is supplied, the better.

Feelings are not causally related to intellectual processes, but are most intimately associated with them. The nature of the relation can best be conceived in physiological terms. No one will question the statement that whenever an intellectual process is experienced, a nervous impulse passes through some combination of cells in the brain. The process of transmission constitutes the physiological concomitant of the intellectual process, and the greater the amount of nervous energy that goes through the brain center, the greater will be the intellectual work accomplished. When an intellectual process of one kind is experienced, one combination of brain cells is traversed: and whenever a different intellectual process is experienced, a nervous impulse passes through a different combination of brain cells. If an object is seen, some combination of cells in the occipital lobe is traversed, while if a sound is heard, a nervous impulse passes through some combination of cells in the temporal lobe. The particular kind of intellectual process that is experienced depends upon, or is determined by, the particular combination of cells through which the impulse is transmitted. We are not able to state the reason for the association of sight

and hearing functions with particular brain centers, but these facts will be admitted by nearly all psychologists.

We have seen that under proper conditions, resistance is experienced in a brain center whenever an impulse of sufficient strength is transmitted through it. Whenever an impulse passes through some combination of cells and accompanies the perception of a raging lion, or an enraged bull, or some other dangerous animal, if the perception is clear, the nervous impulse strong, and the resistance great enough, we experience the feeling of fear. If the impulse passes through some combination of cells accompanying the perception of a starving mother with her family of little children, if the impulse is strong, the perception clear, and the resistance great enough, we experience the feeling of pity. The difference in the things that are seen accounts for the difference in the feelings experienced. Resistance encountered in one combination of brain cells accompanies one kind of feeling, while resistance encountered in another combination accompanies a different kind. Hence we may say that the specific difference in feelings depends upon the brain center in which the resistance is encountered.

It ought to be clearly understood what we mean by a brain center when we assert that the particular feeling depends upon the brain center in which the resistance is encountered. The doctrine of localization of function teaches that particular localities in the brain are devoted to the transmission of impulses that accompany particular mental processes. Thus all the cells that are traversed by impulses when we experience a sight sensation, lie in the occipital lobe. The hearing center, the taste center, the smell center, and a few others have been quite definitely determined, and we may rely rather confidently upon the accuracy of the determination. When the word center is used in this connection, it is understood to mean some

rather definitely circumscribed locality in the brain separated by more or less clearly distinguished boundaries.

Only the simplest mental processes can accompany impulses that traverse cells situated in such definitely circumscribed localities. Almost any kind of a perception will involve several or many sensations, each sensation demanding the transmission of a nervous impulse through one such clearly circumscribed center, and the entire number of circumscribed localities must be traversed by the same impulse. Hence it is that the center, or combination of cells that is traversed by an impulse when we perceive an apple or a landscape, or read a book, or go through a reasoning process, will consist of cells in various parts of the brain, separated, no doubt, in many cases, by its full length and width. It is this entire combination, which is not defined by geographical boundaries, but delimited only by the nervous impulse itself, that we must consider the brain center. Although the cells that compose it may be widely scattered, the one impulse that traverses the entire combination sufficiently defines it, and permits us to speak of it as one brain center.

It must be understood, also, that the same cell or many cells may enter as constituent parts in several or many brain centers at different times. At one time, one cell may constitute a portion of one brain center, and at another it may be traversed by an impulse originating in a different place, entering the cell from a different direction and combining by means of the impulse with a totally different group of cells to constitute another brain center. It is some such conception as this that we must entertain when we use the word brain center in this connection. With this understanding of the use of the word, we may readily accept the statement that the specific difference among feelings depends upon the brain centers in which the resistance is encountered.

We shall avoid, also, the implication that might other-

wise be obtained from the above statement, that there is a brain center for fear and another for pity, one for hate and another for anger. Still more inaccurate are the figures given in some of our text books on physiology that indicate a center for feeling just behind the motor area. No such definite location of feeling can be made. Feeling is not localized in any one place, but wherever a nervous impulse traverses a brain center and encounters resistance, there we have the place in which exists the concomitant of feeling. There is not one center for fear and another for veneration and another for love. To assume something of this kind would be to repeat, without any justification for it, the errors of the phrenologists. There are just as many brain centers, or combinations of brain cells in which resistance will accompany the feeling of fear as there are things of which we may be afraid. There may be a thousand or ten thousand different combinations, resistance in any one of which will be the concomitant of the feeling of fear. There are just as many centers whose resistance will accompany the feeling of shame as there are things of which we may be ashamed. It is some conception such as this that Höfding has in mind when he employs the expression that "The specific differences between feelings we must try to explain by means of the different cognitive elements that may be combined with them." (*Psychology*, p. 222).

This leads us to another observation. As numerous as are the different kinds of feelings, (Titchener suggests a list of more than a hundred) the number of intellectual processes must be indefinitely greater. This must be true, not only because of the fact that different intellectual processes are accompanied by the transmission of impulses through brain centers whose resistance accompanies the same kind of feeling, but because unless the resistance reaches a certain minimum which is difficult of determination, no feeling is experienced, while the intellectual proc-

esses may be very clear. Many intellectual processes are accompanied by no feeling.

While there are different kinds of feelings, they are not very sharply discriminated, and lists that are made have little value. Under one name will be grouped many kinds of feelings, some quite sharply distinguished from others. Mr. Spencer has shown how exceedingly complex is the feeling of love, or, at least, the cognitive elements that accompany it (*Psychology*, I, 487.) Mr. Spencer describes merely conjugal love, or the kind of love that a young man bears for a prospective wife, and the word love is applied to many other kinds of feelings. We can readily understand that any variation in the number of cells and centers that are traversed by the impulse will correspond to a variation in the specific character of feeling. So while there are broad, general distinctions between feelings, it is comparatively useless to undertake to discriminate the different kinds with nicety and sharpness. Much energy may be unprofitably expended in drawing distinctions between such feelings as grief, care, melancholy, wretchedness, anxiety, dejection, gloom, depression. These names for feelings are taken from one of our most popular elementary treatises upon the subject.

It will be understood that one feeling will be specifically related to another in exactly the proportion that the number of cells in the center that offers resistance are identical with those in the combination whose resistance accompanies the second feeling. Hence we shall have all kinds of variations and all degrees of relationship among the feelings. A feeling of one kind may change to a feeling of another kind, even when we contemplate the same object. And this is not because of any difference in "attitude," whatever that may mean, but because of the change in the cells through which the nervous impulse is passing. A person who has never seen nor heard of a rattlesnake, and sees one for the first time, is not in the least afraid

of it. The cells through which the nervous impulse is passing are not those that have been associated with the feeling of fear. But a person who knows what a rattlesnake can do, when he perceives a rattlesnake, sees also his possible death, the suffering that may accompany the bite, the act of striking which the rattle precedes—all of these different combinations are traversed by the same impulse, and the resistance encountered in this entire combination accompanies a feeling of a very different kind from that which accompanies the resistance in the combination which gives merely a visual image of the snake.

Great intensity of fear may be experienced by one who knows all the details about a rattlesnake bite. But if the person becomes familiar with rattlesnakes, has killed many of them and escaped many more, if rattlesnakes come to constitute an ever present element in the perceivable surroundings of the person, the feeling undergoes another change, and very little fear may be experienced. Yet in all three of these cases, the supposition is that the same object is perceived, while really, very different combinations of cells are traversed by the impulse.

Feelings differ from each other in still another respect. Not only is there a specific difference in feelings, but there is a difference in intensity. We may define intensity by saying that it is that property of feeling which we describe by saying that feelings are strong or weak. There are strong feelings and weak feelings. We may have a weak feeling of anger or a strong feeling of anger. We may pity a person much or little. But the feelings are not necessarily of the same specific character in order to be described as strong or weak. We may have a strong feeling of love and a weak feeling of contempt. Strong and weak are always relative terms, and we may designate by them indefinite degrees of intensity which every one will recognize as having been experienced.

How shall we account for this difference in intensity?

We can readily understand that if resistance encountered in the brain center is the inevitable concomitant of feeling, the greater the resistance is, the more intense will be the feeling; and the less the resistance, the weaker it will be. We have in the fact of resistance an explanation of the various and varying intensity of feeling.

Whatever modifies resistance will by the same process modify feeling. We have in this fact an explanation of the decrease of feeling in an habitual experience. No fact is better demonstrated in physiology than that habit tends to diminish resistance, and this fact is generally recognized under the name of the law of neural habit. We have already seen in Chapter II that habit, or practice, diminishes reaction time, and that the limit toward which practice tends to diminish it, is that of a reflex act. But no feeling accompanies a reflex, so we can readily understand that habit, repetition, and practice, may so diminish resistance that all feeling may disappear from the act.

We have in this explanation of intensity, an explanation also of the fact that a thing, incident, occurrence, or event that is observed directly, is likely to be accompanied by a feeling of greater intensity than is one that is merely read about. If we should see a man run over by a street car and mangled out of all resemblance to humanity, the feeling accompanying such a perception would be so strong that we could characterize it only as a feeling of horror. But if we merely read about it in the morning papers, while we may be as certainly assured of the correctness of the account as if we had been present and had witnessed it, the feeling that we experience is very much less intense. Now why should the feeling be less intense in one case than in the other? The facts are the same, our knowledge of them is as clear in one case as in the other, the truth is not called into question in either instance, but the intensity of the accompanying feeling differs widely in the two cases.

For an explanation of the difference we shall have to go back to a previous statement, that a peripherally initiated impulse is always stronger than a centrally initiated one. It has been asserted that every impulse has its origin in some peripheral disturbance, but it is only by an improper use of the term that such a proposition can be maintained. The image of the street-car accident that is read about is initiated by the sensation accompanying the impulse started in the retina by the words on the page, but the image of the accident that is aroused by reading the words is the concomitant of a centrally initiated impulse. So a thing that is remembered is always the concomitant of a centrally initiated impulse, as is a thing that is merely imagined.

A peripherally initiated impulse is always stronger than a centrally initiated one, except in the very rare cases of hallucination. The difference between a percept and an idea depends upon this difference in strength of impulse. The only way we have of distinguishing an idea from a percept is by the vividness of the mental process, which has its concomitant in the strength of the nervous impulse.

In the case of our personal observation of the accident on the street-car line, we have the whole situation presented to us by means of peripherally initiated impulses, which are strong, and the percept is vivid, the accompanying impulses meeting with much resistance. But in case of merely reading the account, the only peripherally initiated impulses are those that enable us to perceive the printed letters on the page, and the scene of the accident is pictured by means of centrally initiated impulses which seldom approximate the intensity, or encounter the same degree of resistance as do the peripherally initiated impulses. A dish of ice cream is much more satisfying to the taste than is one that is merely thought about, and the reason is similar. It is very difficult to reinstate a feeling, or to experience by reinstating the intellectual process, an

intensity of feeling that even approximates that of the original experience.

But let us suppose that we should see a man run over every day by the street car, or that almost every hour in the day some occurrence of this kind should occur within our observation. It would not be very long until we should look upon it as a matter of course, and rather express astonishment when some person less accustomed to such a gruesome sight might reprove us for being callous and hard-hearted. The degree of resistance and the intensity of feeling accompanying the first experience would have become lessened by practice, custom, and habit. Something of this kind must be considered to occur in case of soldiers who have participated in many battles. Physicians undergo the same kind of experience in their dealings with examples of suffering, and the same kind of a change is observed in the case of persons whose duty it is to slaughter animals for market.

In our discussion of the expression of feeling, but little reference was made to the fact that some expressions are much more vigorous than others. We can usually judge of the intensity of feeling by the intensity and vigor of the expression. The feeling and the expression have a direct relation to each other. The more intense the feeling the more vigorous the expression will be. This that is observed might be inferred logically from the facts of resistance. The greater the resistance the more intense the feeling will be. The greater the resistance, the stronger will be the tendency for the impulse to spread out into other centers, especially the motor centers. The portion of the current that escapes from the feeling center will overflow into the expression centers, distributing itself into all of them in a ratio inversely proportional to the resistance encountered in passing into the different centers. Thus it will be seen that we have an explanation of the fact that in cases of strong feeling, at least, there is not merely one

expression center, but, while the larger part of the impulse may flow over into one expression center, many other centers receive some portion of it and some evidence of the expression of the feeling may be observed in many centers. In fact, in cases of very strong feeling, where a great impulse is seeking to go through a center and is meeting with resistance, some portion of the current overflows into almost every motor center and perhaps into almost every glandular center. Thus, in cases of strong feeling, almost every muscle in the body, including the visceral and deep-seated muscles, may manifest some trace at least of the presence of a very strong current.

It will be seen from the above discussion, together with the explanation of what is meant by resistance, (Chapter IV, p. 47) that the amount of resistance and the intensity of feeling depend upon two factors: first, the nature of the nervous arc, the brain center itself in which the resistance is encountered; second, the amount of nervous energy which is transmitted through the brain center. If the nervous arc, or the brain center, is such as to occasion much resistance in itself, the feeling will be strong with a given amount of nervous energy. This condition will prevail if the nervous arc has been traversed but a few times, if the cells are more or less undeveloped, or if there is a pathological condition such as would be symptomized by inflammation. As those conditions are modified, the cells that make up the brain center become more fully developed, the dendrites longer, the distances between their terminations shorter, the cells become habituated to transmitting impulses, or the inflammatory condition decreased, the resistance will diminish, the feeling will become less and tend to disappear.

But none of these resistant conditions will result in very much feeling unless there is a nervous impulse of sufficient strength. If the impulse becomes stronger, the brain center remaining the same, the resistance and the

feeling will increase. If the amount of nervous energy generated be diminished by narcotics, disease, impure air, starvation, or lack of blood supply, the resulting feeling will be decreased as the resistance is decreased. Intensity of feeling depends upon these two factors that are always involved in making any estimate of the amount of resistance.

Besides these factors, the intensity of feeling and the degree of resistance may be increased or decreased, although both the brain center and the amount of nervous energy remain the same, by a process of attention, whose mechanism is to be discussed in a later chapter.

A third characteristic of feeling is tone. By tone of feeling we mean its painful or pleasurable character. This quality is of so much importance in the life of the individual that many writers on psychology have regarded pleasure and pain as constituting the feeling itself. However, such writers never undertake to make a classification of feelings upon this basis, nor to describe the specific differences in feelings that are expressed by the different names applied to the feeling processes, without taking into consideration other things than pleasure and pain. No one fails to recognize that different feelings have different intensities, although the intensity might be described as an intensity of pleasure or pain. Altogether, the statement of Ribot is justified when he says that "It is therefore an error, although common to many psychologists, to consider pleasure and pain as fundamental elements of the affective life. They are only marks. The foundation is elsewhere. What would be said of a doctor who confused the symptoms of a disease with its essential nature." (*Psychology of the Emotions*, p. 32.)

Another group of writers apply the term tone to sensation, and speak of pleasure and pain as the tone of the sensation instead of the tone of the feeling. In many cases sensation as an intellectual process is not discrimi-

nated from feeling, but in other cases it is, and pain and pleasure are considered as the characteristic of the intellectual process. One may very readily be pardoned for confusing pain and pleasure with the intellectual process in the absence of any satisfactory theory of the relation between feeling and the intellectual process that accompanies it, but it is necessary to discriminate the two, and there is no justification in the present state of psychological knowledge for failing to make the distinction. It appears that the clearest way in which to describe the relation is to figure it in terms of a physiological process. The difficulty of establishing such an understandable hypothesis is sufficient explanation for much of the obscure and indefinite thinking upon this subject. If we consider the impulse that passes through the brain center as the concomitant of sensation, and the resistance that stops out part of the nervous energy as the concomitant of feeling, we shall have a means of clearly discriminating the two, and seeing the relations that they hold to each other. We shall then see that pain and pleasure are properties, not of the intellectual sensation, depending upon the amount of nervous energy that goes through the brain center, but of the feeling, which depends upon the degree of resistance, and varying with the amount of nervous energy that is stopped out and destroyed in the transmission.

It is scarcely advisable to make the distinction between pain and unpleasantness as some writers do. It is the same kind of distinction as that which is drawn between physical feeling and mental feeling, between sensation and reasoning, between affection and emotion. Physical pain may differ from mental pain, but this is merely a specific difference depending upon the difference in brain centers in which the resistance is encountered. Also, physical pain is usually more intense than is mental pain, since in the activity of a sense organ, which is always employed as an illustration of physical pain, the peripherally initiated

nervous impulse is stronger, while in the impulse that accompanies mental pain, there is a much larger proportion of the centrally initiated energy. As a usual thing, the physical pain, that is so available for illustration, is more intense and less massive. These two qualities have their correlates in the fact that the nervous impulse in case of physical pain is peripherally initiated, and that the brain center through which it passes is likely to be composed of a smaller number of cells. However, the tone is the same, no matter how great the specific difference in the feelings may be.

Pain and pleasure are not specifically different from each other but differ rather quantitatively than qualitatively. Pleasure may pass into pain, and pain into pleasure, or, perhaps for the sake of accuracy, we ought to say that a feeling of a painful tone may pass into a feeling of the same specific character having a pleasurable tone. The tone of the feeling may change without there being any change in the specific character. We may experience a feeling of a painful tone when our hands are cold. When we come near a hot stove, the feeling of warmth has a pleasurable tone. As our hands become warmer, the feeling may change to one of a painful tone. It is the same feeling, accompanying the sensation of warmth, and we may call the feeling by the same name, warmth, if we do not confuse the feeling with the sensation, in consequence of applying the same name to both. The odor of flowers is pleasant, but if the perfume is intensified, the accompanying feeling will, with nearly any odor, become painful.

Here we have an example of a general law of feeling tone. Nearly any feeling of a moderate degree of intensity has a pleasurable tone, but the same feeling with a greater degree of intensity will have a painful tone. In general, the tone of the feeling depends upon its intensity. This is a matter of direct observation, and corroborates our theory of the

resistance being the concomitant of feeling. A few possible exceptions to the general law will be noticed later.

Up to a certain point, the greater the intensity, the more pleasant the tone; and beyond that point an increase in intensity increases the pain. We can understand that by varying the intensity we may cause a feeling having a pleasant tone to change to one having a painful tone, and conversely by varying the resistance and the intensity in the opposite direction, we may cause a feeling having a painful tone to change to one having a pleasant tone. Nearly all persons like sweet things, but food may become so sweet as to be sickening. The Heaven of eternal rest appeals only to persons who labor hard every day.

A feeling having a painful tone may change to one having a pleasant tone by varying the resistance, either through habit, attention, or diminution of the amount of nervous energy so as to produce less resistance and less intensity of feeling. Washing dishes is with many girls a very disagreeable occupation, as is the weeding of the onion bed to a small boy. But by continued repetition, the feeling becomes diminished in consequence of the diminished resistance incident to an habitual act, and the feeling takes on a pleasant tone. Almost any occupation that is pursued conscientiously ceases to be painful, becomes endurable, and finally pleasant. It is not often that an occupation that is pleasant in the beginning, remains pleasant continuously. It becomes, not painful perhaps, but rather monotonous and ceases to furnish pleasure.

There is one phenomenon of feeling that has led many persons to question the validity of this origin of the painful tone of feeling. It is true that the same intensity of feeling may under one kind of circumstances be pleasurable and in another painful. The best illustrations occur in cases of physical pain. When a person has a toothache, a certain degree of intensity is exceedingly painful if the intensity of the ache is increasing, while exactly the same

intensity will appear pleasurable if it is decreasing. The same thing is true if we place our hand in water of a certain degree of temperature. If the hand is placed into the hot water from a temperature that is less, the accompanying feeling is painful, while if it is placed in it from a temperature that is greater, the accompanying feeling is pleasurable. Let us suppose that the feeling, whatever it may be, has increased from an intensity of three to an intensity of four. The increasing intensity is recognized as painful. But if the feeling is decreasing from an intensity of five to an intensity of four, the intensity of four is regarded as pleasurable. It will be understood that we have assumed the intensity of four as the neutral point, or the point of indifference, or near it.

This is a matter that has led to the statement of theories of feeling that do not regard intensity as the necessary condition of pleasure and pain. It is upon this series of phenomena that Meyer's theory (See p. 26) is based, and it explains them well. Let us see how the matter may be explained by means of the resistance.

We know that a brain center is modified by the impulses that pass through it. It is modified by many repetitions in such a way that a nervous impulse of the same strength will go through it with less resistance, but it is modified much more promptly by a larger impulse than by a smaller one. If a very strong nervous impulse is passing through the center, it modifies that center very promptly so that a nervous impulse of a less degree of intensity will pass through it with little resistance. The resistance will vary, probably with some function of the strength of the current; such as the square, or some higher power. So after a strong nervous impulse has passed through, the resistance in the center is much diminished. But if the impulse passing through has been a weak one, the stronger impulse will encounter resistance greater according to some function of the impulse preceding. If the point of intensity

is near the critical point, the difference may be such that the resistance is great enough, with the same strength of current in one case, to accompany a pleasurable feeling, and in another to accompany a painful feeling.

In this discussion of the change from a pleasurable to a painful tone, it has been assumed that in passing from one to the other a point is reached at which the tone can be described as neither pleasurable nor painful. The feeling having the most pleasant tone is the one having the greatest intensity just before the point of pain is reached; or, avoiding circumlocution and sacrificing accuracy of expression for the sake of clearness, we may say that the more intense a feeling may be without its becoming painful, the pleasanter it is.

The point at which pain changes into pleasure, or pleasure into pain, is called the point of indifference. This must be carefully distinguished from the point of monotony, at which all feeling, and consequently all tone, disappears. The failure to make this discrimination has led many writers on psychology to deny that there is a point of indifference. The point of indifference is a condition in which there is much resistance encountered, and accompanied by a feeling of considerable intensity. The point of monotony is one in which there is little or no resistance, no feeling, consequently neither pain nor pleasure is experienced. The two things are not identical nor very closely allied, but much confusion has been caused by failing to notice their difference.

We may say in general that actions which accompany feelings having a painful tone are injurious, and those that accompany feelings having a pleasurable tone are beneficial; or, painful feelings are injurious and pleasurable feelings are beneficial; or more briefly and still less accurately, we may say that pain is injurious and pleasure is beneficial.

It will be readily understood that whenever pain arises

from a degree of resistance that accompanies a feeling of excessive intensity, some injury is likely to result. It is pleasant to see the sunlight, but to look directly at the sun engenders a feeling of such intensity as to be painful and is injurious to the eyesight. The feeling of fatigue is a painful feeling and the actions that give rise to it are so excessive as to be injurious if persisted in. It seems, then, that pain arises whenever the activity of any organ is of such a nature that its continuation will prove injurious to the organ exercised.

This may be stated physiologically by saying that an activity is accompanied by a feeling having a painful tone whenever the destruction of tissue in the organ, nervous, muscular, or glandular, goes on more rapidly than it can be restored. When the destruction of tissue is not greater than can be restored as rapidly as it is used up, pain will not ensue. Whenever a nervous impulse encounters great resistance, we have a condition in which there is a rapid destruction of tissue in nerve and brain. We cannot have great resistance without the liberation of much nervous energy, and this implies rapid oxidation of tissue.

The illustrations employed have all been of the kind that is called physical pain, but the same thing is true of other kinds of pain as well. When the action is of such a kind as to be destructive to the social organism, then the pain is likely to be a mental pain, and follows the same law. An action that is injurious to the social whole is likely to be a painful action. An action that is injurious to racial propagation is likely to be painful, not perhaps physically but mentally. In this case, the social structure may be read in place of the physical organism, and the same law will apply.

The statement that pain is injurious is only partly true, and in order not to be misleading must be properly understood. We mean that in general those actions that are accompanied by feelings having a painful tone are in-

jurious, while those actions that are accompanied by feelings having a pleasurable tone are beneficial. Now it seems as if we had a statement of a very satisfactory theory of life. In order to do the things that are beneficial, we need only to do those things that are pleasant and avoid those that are unpleasant. We are thus landed into the philosophical system of the Epicureans. But there are so many instances of a contrary nature that we are inclined to question the philosophical soundness of the doctrine. If I should never do anything unpleasant, why am I advised to take quinine, or castor oil, or something else that is equally distasteful? Why is it that medicine which I am told is good for me to take nearly always tastes bad? Why am I told that the things that I like to eat best are nearly always the things that are most likely to be injurious to my health? Why am I advised to get up early in the morning and to take exercise when I should so much rather not? Why am I advised to study in school the things that I like least or, perhaps, why should I find it necessary to go to school at all when I would so much rather play?

The answer is rather easy. If we were perfectly adjusted to the environment in which we live, then the rule would hold good in every instance. Those things that are accompanied by pleasant feelings would always be beneficial, and those that are injurious would always be accompanied by unpleasant feelings. But we are never perfectly adjusted to our environment and never can be completely so. Our environment changes, seasons change, children grow, improvements are made in methods of work, habits of living, and social ideals. Our ancestors lived in a different climate and in different surroundings from what we do, and our whole hereditary fabric must be readjusted to the changed conditions. Our environment changes and our perfect adjustment is destroyed. It is in the process of readjustment that the beneficial

action is accompanied by an unpleasant feeling. If we had been accustomed to take a dose of quinine every day for generations, and those persons who did take the quinine were the only persons who lived and left descendants, while those who failed to take quinine died without leaving descendants, the taste of quinine would without doubt ultimately become as pleasant as is now the taste of sugar. So any process that is unpleasant but beneficial would ultimately become pleasant if the same condition prevailed, and the environment to which the activity constituted an adjustment remained the same.

Not only is pain in itself not injurious, but both pain and pleasure are alike beneficial. Pain is beneficial because in consequence of it we are induced to cease doing the things that are injurious. Pleasure is beneficial because by means of it we are induced to do the things that are advantageous to ourselves as individuals, to the community, or to the race. The painful tone of the feeling of hunger leads us to eat, and the pleasurable tone of the feeling accompanying the process of eating contributes to the same result. Both the pain of hunger and the pleasure of eating conspire to induce us to eat, and when we realize that to eat is the first condition of living, we shall see that the process is not too well guarded even by both pleasure and pain. In animals born like Mr. Hodge's puppies—having the fibers in the brain non-medullated, no eating instinct developed at birth and no nervous organization that led to it—death is of course inevitable. They were described by Mr. Hodge as non-viable.

Pain is a symptom of disease. It is a warning. As Dr. Woods Hutchinson calls it, it is the great danger signal of nature. The business of treatment is to cure the disease, not merely to mitigate the pain. If the pain is not relieved by the cure of the disease, but is mitigated by the use of narcotic drugs, or even by faith cure, or Christian Science, the relief of the pain is an evil rather than a good.

Some diseases, like consumption, leprosy, and syphilis, are exceedingly dangerous, merely because in their early stages they are accompanied by no pain. More persons die of consumption every year in the United States than of any other disease, and yet, in its early stages, it is one of the most easily curable of diseases. If it were accompanied in its early stages by as much pain as a sore finger, no one would in all probability die of consumption.

Pain and pleasure have been described as different degrees of intensity in the same feeling. Any feeling may have a painful tone or a pleasurable tone, depending upon the intensity of the feeling and its correlative resistance in the brain center. While this is in general true, it is possible that a modification of it is needed in case of some of the most important activities. It is possible that some actions and some conditions are always painful, no matter how little the intensity may be. It is doubtful if the feeling of hunger is ever pleasant. Possibly the feeling of fear, which is a feeling of great importance in the preservation of the individual, is never pleasant. Some feelings may be as consistently pleasant, if they are of equal importance in the preservation of the individual or the race. It has been observed that the sexual feeling is never painful, and no other feeling is of so great importance in the perpetuation of the species and the race. It seems as if the activities of such tremendous importance cannot be trusted to the judgment of the individuals; or rather, that those individuals and those races in which these important feelings always had these particular tones were the races and the individuals best adapted to leave the largest number of descendants, and whose descendants had the better chance of surviving. It has seemed as if the feelings of this kind must be provided for furnishing motives of the utmost intensity. Such examples, however, furnish no grounds for postulating a separate apparatus for pleasure and pain. They are brought directly under the laws of

feeling, and explained by the resistance that is encountered in the brain centers traversed by the appropriate impulses.

Pain and pleasure, then, the tone of feeling, is that characteristic of feeling that induces the individual to perform actions which tend to preserve his life, or the lives of the community, or the life of the race. Physical pain leads him to perform actions that tend to preserve his own individual life. Mental pain is strictly homologous to physical pain in that it leads him to perform actions that tend to preserve the community. There is no essential difference. It is of equal importance to preserve the community as it is to preserve the individual.

We are so much accustomed to think of pleasure and pain as incentives to our actions that we can scarcely conceive that other creatures may not be actuated by the same devices. But to assume that pleasure and pain are universal in the animal kingdom, and still more in the plant world, would not be justified by anything that we know. We are well aware of the fact that pleasure is a device by which the propagation of the race and the continuity of the species is secured in the higher order of animals, but how shall we account for the sexual propagation of fishes in which the co-operation of male and female is necessary, but in which there is no contact of the two in the process? We are inclined to attribute the squirming of the earthworm when it is cut in two, to the fact that it feels pain. But there is really no more reason for considering the squirming a manifestation of pain than of pleasure. It might be an expression corresponding to our violent exertion of laughter, so far as we can discover, and Mr. Loeb believes that the earthworm feels no pain when it is cut or pressed. A beheaded hen is moved to violent action, but we can scarcely see how a hen with her head cut off can experience pain, or even pleasure. The action of a sensitive plant is not different from that of many

animals whose actions we call expressions of pain, yet no one believes that the sensitive plant experiences pain. Although insects are rather highly organized creatures, it is doubtful if they are protected in the same way by the device of pain. At least, it would be exceedingly difficult to demonstrate that they are.

SYNOPSIS.

1—*There are three properties of feeling, specific character, intensity, and tone.*

2—*Specific character is that property which is expressed by the employment of different names for feelings. It depends upon the particular combination of brain cells in which the resistance is encountered.*

3—*Intensity is that property of feeling which is expressed by the words strong or weak. It depends upon the amount of resistance, and consequently the intensity is modified by the condition of the brain center, by the strength of the current, and by attention.*

4—*Tone is that property of feeling which is expressed by the words pain and pleasure. It primarily depends upon the degree of intensity, but in a few of the most essential feelings variation in intensity does not cause a change in tone.*

5—*In general, a feeling has a painful tone when the resistance accompanies a degree of activity that destroys tissue more rapidly than it can be restored; pleasure is experienced when the degree of activity permits the restoration of tissue as rapidly as it is destroyed.*

CHAPTER VII

THE CLASSIFICATION OF FEELINGS.

There can be only two purposes in the classification of a series of objects or processes: one is that of enabling us to remember the series more readily. When such is the purpose, the basis of classification is likely to be some purely accidental circumstance, and the resulting classification would not be considered as possessing a high order of merit. The second purpose in classification is to show forth some relation that would not otherwise be discovered. Such a classification would necessarily have for its basis some important characteristic, and the classification would exhibit the natural relation between the objects classified, manifesting their nature more fully than would be possible without it.

In the classification adopted in botany and zoology, which are the classificatory sciences *par excellence*, the classification called the natural system is intended to show the relation by descent of the animals and plants classified. It exhibits the genetic relationships which they bear to each other. This kind of classification is of so much more importance than any other, and exhibits relations of so much greater value, that it has completely superseded all others, and is used as the basis for assigning names to the different species.

As there is but one important natural classification for animals and plants, so there is but one natural classification of the feelings that shows forth such essential relations as to make it worth while to present. This natural classification is one that manifests the relations among

feelings according to the function that they perform in the life of the individual and the race, and the manner in which they have originated.

One difficulty in classification of feelings is that up to the present there are very few specific determinations of feelings, and no settled method of procedure in determining them or discriminating one from another. A list of all the feelings that are mentioned by each of four or five different writers on feelings will show no agreement at all, even in names, beyond a very few feelings. A counting of the different feelings mentioned in the books of four writers, all of whom have written fully upon the subject, shows that the number varies from seventeen to a hundred and eighteen. While no one writer probably intended to make a full list of feelings, nevertheless, if they had so intended, it is probable that the lists would have varied as widely. A casual examination of the several lists shows, also, no general agreement among the feelings that are named, and certainly there are many synonyms in the longer lists; and without doubt, several kinds of feelings are included under one name in each list. It would seem that some method of making specific definitions of feelings and delimiting one from another is urgently needed.

In all classificatory sciences, it has been found of very great assistance to adopt some general scheme of classification first, and then the different species find their places readily in that scheme. If we can establish some system of classification that will exhibit the most important relations, it will assist greatly in the description of the species.

The natural classification of the feelings is one that shows the function of the feelings in the development of the individual and the race, and indicates as a logical necessity the manner in which each feeling has become established as a human characteristic. To Herbert Spencer the recognition of this characteristic of feeling

as a basis of classification is largely due, and the method of classifying adopted here is derived from him, with, however, some important modifications that the sixty years which have elapsed since Herbert Spencer wrote have shown to be necessary.

One general principle must be recognized in the study of the feelings. Every feeling has now, or has had in the recent past, some advantageous function to perform in the life of the race or the life of the individual. In consequence of the benefit that it has been in some way, the feeling has become what it is. If any feeling that is now experienced should prove to be injurious to the individual, or to the race through the individual, that feeling would disappear ultimately as a human characteristic in consequence of the elimination of the individuals in whom such feelings manifested themselves in an injurious manner. So a feeling that has proved itself to be advantageous to the individual, or to the race through the individual, has become fixed as a human characteristic by means of the advantage the individuals who experienced the feeling had over those individuals who did not possess it. In this way, the feelings have all of them originated by variation, become fixed by natural selection, and been transmitted by heredity. It will be understood that when we speak of feeling being transmitted by heredity, we mean that a nervous organization involving the capacity for resistance in particular brain centers has been inherited. It is the nervous system with all its characteristics and tendencies that is inherited.

This is the ordinary law of natural selection, and while its operation is difficult to trace in mental processes, its efficiency has been manifested in so many directions that there is no hesitation in making this application of it, especially in the domain of the feelings.

In the development of any species of animals or plants, some means must be employed to secure the preservation

of the individual and the propagation of the species. These are the two fundamental processes, and since in the human race the feelings largely determine the actions that secure these two results, it is possible to reduce all feelings to two great classes, one class being those feelings that lead to the preservation of the individual, and the other, the group of feelings that lead to the propagation of the species. These two groups of feelings are basic, and it is impossible to conceive how without them the race could have survived, or have come to constitute a factor in the living world. No system of philosophy can ever hope to prove satisfactory as an explanation of human events that does not see all human actions springing out of these two great functions. Hence we may expect the primary classification of feelings to be into the two groups, the self preserving and the race perpetuating.

But early in the history of the race, another principle came into operation. This is expressed in the gregarious principle by which human beings came to live in herds, or in society. The social organization has had such a tremendous influence in increasing the power of the individual, leading to the greater efficiency of the self preserving activities and multiplying the number of individuals that constitute the species, that in periods of the past comparatively recent, the function of social organization has become of almost equal importance with that of the self preserving function. Hence it is that while the feelings that lead to actions which maintain the social function have been derived from those of the self preserving group, we must set them off by themselves as an independent group, yet showing traces of their self preserving origin.

Not only human beings have adopted the community habit of living, but we find it originating independently in many species of animals. It is better exemplified in ants, bees, and social wasps than it is in man. Whether it is

there a manifestation of the same kind of feelings that have induced it in the human race or not, may be questioned. Whether bees and ants are creatures of feeling, and their actions determined by it, we are unable to say. It is possible that the social organization, resembling in external features the social organization of man, may have been induced by the operation of some other principle than that of the social feelings. But in mammals we have many examples of social organization, and here we are better prepared to assert a similarity between the feelings of mammals and the feelings of man.

Since there are three important activities in the life of the race, we shall recognize that there are three great groups of feelings, each corresponding to one of these functions. The three groups are the self-preserving feelings, which are called by Mr. Spencer the egoistic; the community preserving feelings, corresponding somewhat closely to Mr. Spencer's altruistic; and the race perpetuating feelings, which include without having the same limitations, Mr. Spencer's group of the ego-altruistic.

The self preserving feelings, having once been named, need no definition nor description. They constitute a large group of feelings that accompany the actions which lead to the preservation of the individual. Examples of this group may be found in abundance. All of the feelings that accompany the physical functions, except the sexual feelings, belong to this type. The feeling of hunger leads to the preservation of the individual by inducing actions that procure food. The pleasure derived from eating is of the same kind. Thirst, nausea, fatigue belong to this group. The advantage of fatigue is very evident. Excessive activity of the muscle leads to the destruction of tissue more rapidly than it can be replaced, and danger of permanent injury is immanent. But the feeling of fatigue accompanying the increased resistance in the muscular center, necessitates a cessation of activity.

The nervous mechanism by which this result is brought about is not difficult to understand, if we remember that nervous energy is necessary to make a muscle contract. Fatigue may be either muscle fatigue or nerve fatigue. The excessive oxidation of tissue may be in either organ, but it is detrimental in either place. The toxic products of fatigue are distributed over all the body by the blood faster than they can be eliminated, hence the feeling of fatigue is a general one, and every organ in the body seems fatigued. As a result of this feeling, the excessive activity is likely to be discontinued before injury is done. If it were not for the painful tone of fatigue, in very many cases injury would result, the individual would be seriously injured, and a smaller number of persons would survive to reproduce and leave descendants.

Not all self preserving feelings are related to the physical functions. A good example of a self preserving feeling is the feeling of fear. We have seen in a previous chapter that the various expressions of this feeling are actions, each of which in its appropriate situation tends to preserve the life of the individual. The shriek of the child, the flight of the man, the fear paralysis of either the child or the man, each in its own place may preserve him.

We have seen also that the child is more nearly a creature of feeling than is an adult individual. He experiences feelings of a greater intensity, and a larger part of his nervous energy is expended in overcoming resistance. But with a child, the activities are more nearly limited to the preservation of himself than are the activities of older persons. Hence we find, just as we should expect, that the feelings of a little child are almost all of the self preserving kind, or selfish feelings. A little child is a bundle of selfishness, and there is no room in his heart for feelings of self abnegation. He does not care in the least how much trouble he may cause his parents. He has no shame, modesty, reverence, gratitude,

remorse, sympathy, or pity. His only business is to live, and he makes every circumstance subservient to that end. He lives, not in his sensations, but in his feelings.

Without some understanding such as this, we shall be unable to interpret the actions of children. It is a failure to appreciate the circumstance that the feelings of children are of necessity altogether of the self preserving group that has led to the doctrine of total depravity. The doctrine is inevitable, if we fail to take into account the function of the feelings that a natural classification discloses.

The plays of little children below the age of seven are almost all such as give rise to this group of self preserving, or egoistic feelings, associated with the sense activity. We may call the activity of the senses in themselves, sense plays. All of the plays of little children are sense plays, involving the feelings appropriate to the senses, and they are individual plays. It will be readily understood that the functional activity of the senses is in itself an advantage to the child, strengthening him and enabling him to grow, becoming all the time better able to maintain himself in the struggle for existence.

The organization of brain centers goes on as the result of impulses originating in play. Sight, hearing, muscles with their brain connections, grow as they are exercised. Not only do they grow and the cells which constitute them become developed, but they become associated, and association fibers develop between centers in the direction that the impulse runs. It is through the play activity of the senses, particularly the muscular sense, that the muscles become strong and capable of coordination.

The second great group of feelings are the community preserving, or altruistic feelings. The name community preserving is much to be preferred, since it renders superfluous any explanation or definition of the group. The community preserving feelings are those feelings which

accompany actions that tend to benefit the community. While this group has been developed out of the self preserving feelings, it was split off from them very early in the history of the race, at the time when it adopted the gregarious habit of living. It is probable that the community preserving feelings exercised little influence upon the actions of men before the time that is known to anthropologists as the period of middle barbarism, when first the community and tribal organization began to be effective. We should not expect any great strength in the community preserving feelings until there was a community to preserve, and the community would in all probability develop coincidently with the growth of the appropriate feelings.

It is possible to show that the community preserving feelings have been developed out of the self preserving, and that they are in their origin the same. Hence it is not at all a matter of surprise to us that so much ingenuity has been expended in showing that altruism and egoism are at bottom one and the same thing. The person who preserves and benefits himself, at the same time benefits the community of which he forms a part, by furnishing it with a more efficient member. So the person who does something to benefit the community, at the same time is benefiting himself, since he constitutes a part of the community to whom the benefit of his action accrues.

Community life has become such an important function in human development that perhaps the larger part of our actions consist of those that are performed directly for the benefit of some one else. No one of us has built the house in which he lives, nor made his own clothes, nor obtained any large proportion of his own food. The result of our work has been distributed over a hundred different persons, and we have drawn from a thousand to obtain the things that we need every day.

We can readily think of pity, sympathy and charity as example of altruistic feelings, but it is rather more difficult to see that the man who shovels coal into another man's cellar is engaged in an altruistic act, or that the man who puts up a sign in front of his store to indicate where goods may be bought is equally commendable for his altruism. Our content for the word altruism is altogether too narrow to fit the circumstances. As habitually employed, it includes something of the idea of sacrifice and painful tone in the feeling that accompanies the altruistic action. Such is not a proper meaning for the word, and the description of the way in which such a perverted meaning came to be applied to it furnishes a most interesting chapter in the history of philosophical doctrine.

Any action that directly results in benefit to some one else is properly a community preserving action, and the feelings that appropriately accompany it are altruistic, or community preserving feelings. We fail to recognize it as such in many cases, because by habit the feeling has largely disappeared from most of the community preserving actions that we do.

To this great group of community preserving feelings belong all the feelings that we have been accustomed to call the moral feelings. Justice, truth, charity, integrity, all of them necessary for the preservation and strength of the community, and all the feelings that we call the moral virtues belong here.

But there are other feelings belonging to this group whose position is less readily seen. Courage is the great virtue, and in fact is the mother of all the others. Courage is the feeling that leads a man to go into the army and fight, even though he may know that he will be killed. In this way it comes directly into conflict with fear, the self preserving feeling. Courage, not hope, is the antithesis of fear. The individual who goes into battle and fights, and is killed, benefits the community, not directly by get-

ting himself killed, though all of us have known persons whom we had reason to believe could benefit the community more by getting themselves killed than they could in any other way; but the man who goes to war, and fights the enemies of his country, and thereby prevents the destruction of the entire community, even though he be killed himself, preserves the community for which he fights. The death of the individual, especially one who has courage, and the virtues that properly associate themselves with it, is directly an injury to the community. But in case that the existence of the entire community is threatened, it is advantageous to set aside a portion of the community, even one tenth of its members, to fight and be killed and offered up as a sacrifice, if thereby the safety and continued existence of the community with nine-tenths of its members is assured. Hence it is that courage is a moral, community preserving feeling.

It is interesting to note that in those animals in which the gregarious instinct is most completely developed, fear seems to be wanting. The social insects—bees, ants, wasps—seem to have none of it. Nothing is more courageous than is a bee or an ant. The individual appears to be nothing, the community is everything, and every bee is perfectly fearless, ready and willing to attack anything without regard to consequences to himself. This arises from the greater intensity of the community life, and probably also from the very rapid rate of reproduction, rendering unnecessary for the community existence the same amount of care in the preservation of the individual.

Among the community preserving feelings we must class some that at first glance appear to be directly contradictory to the definition implied in the name community preserving. Here belong such feelings as anger, hate and revenge; the feelings that are classified by some psychologists as the malevolent group. It appears to be al-

most a paradox to class them with the altruistic, or community preserving feelings, because to our common thought it appears that they are rather community destroying feelings. But we must look for a justification of our grouping to the function that they had in racial history when they became fixed by the process of natural selection. In certain stages of society which we call savage, it is universally regarded as a moral obligation to take revenge for the killing of a kinsman, or fellow tribesman. The slayer himself, or some member of his family must be killed, and a relative of the murdered man who does not seek revenge is considered immoral, and regarded as unworthy of fellowship in the tribe. Even now in warfare, it is considered necessary to stir up hatred and revenge toward the members of the nation with which we are at war. It is necessary to "fire the national heart." This induces enlistment in the army, prevents desertion, and makes better fighters. An army disintegrates if its soldiers become friendly with the soldiers of the enemy.

Hatred, anger and revenge have an advantageous function, similar to that of warning colors in animals. A bumblebee is not likely to be disturbed and injured if one knows that it is there. Its bright color shows where it is. So if it is known that the killing of a person or a member of a tribe will be inevitably followed by reprisals, that person or tribe is not likely to be molested.

It is perfectly allowable to hate an enemy in warfare and to kill him if we can. That is what a soldier is hired for. He must kill, destroy human life, and the feelings that are appropriate to such action, and lead to such killing, are moral, virtuous, tending to preserve the community. These feelings have their appropriate function when they are directed toward the enemies of the community, and when so directed they tend to preserve it. They receive their reprehensible character when, instead of be-

ing directed toward the enemies of the community, they are directed toward members of the same community. Then they become immoral and a detriment to the community itself. Since warfare has ceased to be an universal and constant occupation, these feelings have largely lost their appropriate character, and persist rather as vestigial feelings than as feelings whose functions are still important. They have ceased to be regarded as moral, and have come to be considered immoral, which fact is in itself an indication of their vestigial character.

We find anger and hate best exemplified in those members of the community who are least developed, among the uneducated, the lowest strata of society, and the near-criminals. They are least exemplified among the better classes of persons in the community, and when they are experienced, they are never boasted about, but concealed with shame. So when we find anger and revenge exhibited by little children, we can recognize these feelings as an indication of an undeveloped condition, and perhaps an indication of the bringing forward of a tendency that is becoming vestigial, and being dropped out of the life of the race as a characteristic of a human being.

We can readily understand that pity, sympathy, and charity are moral, altruistic, community preserving feelings. They benefit the community by preserving those members of it who are unable to preserve themselves. It is by these community preserving feelings that the community is bound into a solidarity and each is ready to help all the others. But a question arises, whether these feelings of pity and sympathy may not become hypertrophied, and be a source of weakness instead of strength to a community. We know that there are dependent classes in the community that must be supported and maintained by the other members. There are paupers who are unable to make a living, or to contribute to the strength of the community even so much as to produce

what they consume. They must be maintained by the labor of others. Often these are in special institutions, and in so far as they detract from the effective labor of the rest of the community, they may be regarded as a source of weakness. Then there are insane persons, who can never hope to be cured, but must be cared for, and thereby they detract just so much from the strength and efficiency of the community. Besides these, there are criminals, some of whom can never become anything else, and in order to prevent their preying upon the community, it is found profitable and productive of less weakness to the community to confine them in stately mansions where they are cared for by painstaking attendants.

These dependent and defective classes constitute a serious burden upon the community, and detract from its strength and effectiveness. There is no doubt that the community would be strengthened by the elimination of perhaps one-tenth of its members. Why shall we not eliminate them? When a person is recognized as a confirmed criminal, the chances of whose reformation are quite remote, why should he not be killed at once? When a person has become incurably insane, why not execute him in the least painful manner? If a person is a pauper, unable to make a living, so that he must be supported by the labor of some one else, who not only makes his own living, but can spare a surplus from the product of his labor, why not prevent such pauper's weakening effect upon the community by killing him?

It is also true that the weak, inefficient, criminal and insane classes, tend to perpetuate their kind, and the history of several families, of which the Jukes were the first studied, show that in our present society there is no tendency toward their elimination.

To such reasoning only one effective argument can be offered. It is true that these defective and delinquent persons are a source of weakness to the community and

their elimination would strengthen it. It is true that the strength of the community preserving feelings of pity, sympathy and charity tend to perpetuate this weakness. But any community in which the feelings of pity and sympathy and similar feelings that tend to preserve the community and to generate a community spirit are so weak as to permit the killing of these defectives, would be held together by bonds so feeble that the community would inevitably disintegrate. The only remedy is not elimination of defectives after they have appeared, but the prevention of their appearance by the removal of causes, medical treatment, education and other means that will diminish the proportion in the community while still preserving the full effectiveness of the feelings that prohibit their removal.

A third group of feelings are the race perpetuating feelings. These feelings are fundamental in the development of the race, and have the same basic position as do the self preserving feelings. They are even more fundamental than are the community preserving feelings, and are even more powerful in leading to action, although their range is more circumscribed.

Beginning with the feelings that accompany the sexual sensations, we find the race perpetuating feelings are such as are incident to the rearing of children and the propagation of the species. Perhaps the best example is the love of a mother for her child. This is a feeling of such intensity that it will overcome almost any other kind. A woman is likely to be influenced strongly by the feeling of fear, a self preserving feeling. But the influence of mother love will completely annihilate the self preserving feeling, and make of the mother an embodiment of courage.

The race perpetuating feelings are especially those that are incident to family life, such as the love of a man for his wife, a wife for her husband, either present or pros-

pective, of parents for children, a brother for a sister, or perhaps better, for somebody else's sister.

If we examine these feelings in the light of their origin and their function, we shall readily see why it is that the love of a parent for a child is likely to be greater and to differ qualitatively from the love of a child for a parent. The love of a parent for a child is an example of race perpetuating feelings, and has its utility in the continuation of the species. The feeling is so strong and of such a character that the parent will prefer to die before the child does. Nearly any parent will, if necessary, give his life for that of the child. A parent can be injured in no other way so severely as through his child. We may fix the natural termination of the life of a man at the conclusion of the reproductive period, just as it is in the ragweed, or any other plant in a high degree of organization. This limit must be set not at the time of the birth of the last born child, but must include the period of helplessness of the last born infant. This would bring the theoretical limit up to not very far from the traditional three score and ten.

The love of a child for a parent does not contain the same elements of feeling as does the love of a parent for a child. The love of a child for a parent can scarcely be included in the list of race perpetuating feelings. The love of a child for a parent in the first period of a child's life, up to the age of about seven, belongs rather to the egoistic feelings, and is advantageous to the child in enabling him to live. Then comes a change in the feelings of a child when he is unconsciously struggling to make himself independent, the feelings for a parent change and the new feeling is one that must be classified with the community preserving group. The three kinds of feeling designated here by the one word love are as specifically different from each other as are the feelings of philo-progenitiveness, pity and pride. The change in the feel-

ings and attitude of a boy toward his father, when we compare them at the time when the boy is six with those of the same boy at the age of eleven is something to excite wonder, and deserves more study than it has ever yet received.

A parent may naturally expect to die before his children do. The death of a child, or of children is likely to prove disastrous to the subsequent vigor and courage and general usefulness of the parent. If the same kind of an effect were to be produced upon the child by the death of a parent, the total effect, manifested upon all the persons in the community who have parents die, would be disastrous. Hence it is an advantage to the community and to the race that the feeling of a child for a parent should not be of the same kind, nor so intense as that of a parent for a child.

It is interesting to note that the love of parents for children, philoprogenitiveness, is much less strong in those animals in which the rate of reproduction is very rapid and very high. It quite disappears in fishes, some of whom lay many thousand eggs every season and take no care of their young. The same thing is true of frogs and toads. Calculation shows that a single toad will lay ten thousand eggs in one season, and although the eggs are very carefully placed, no further attention is paid to them, and we are compelled to believe that the feeling of philoprogenitiveness is absolutely lacking. A full grown bullfrog will eat its own progeny as readily as it will any other kind of food. Of the ten thousand eggs, not more than two on the average, will come to maturity. It appears that the large number of eggs is one device by which the perpetuity of the race is assured when the feeling that prompts parental care is wanting; while, when it is present, not so many eggs or so many young are produced, and the reproductive forces are conserved by it. There are, then, two different devices by which the race

perpetuation is secured, and, in the human being, the device that is employed is the race perpetuating feeling of philoprogenitiveness, instead of large reproductive power.

In plants we have a manifestation of the same device that is employed in the case of fishes and toads. The race is perpetuated and improvement is secured by a high rate of reproduction, or the production of a large number of seeds. In this way, the device of philoprogenitiveness is rendered unnecessary. A single ragweed may produce five thousand seeds, and some plants have a higher rate of reproduction.

The race perpetuating feelings are rather late in appearing, and scarcely make themselves manifest in typical forms before the age of adolescence. Then they assume a dominant importance in the life of the individual.

All the feelings that are experienced may be classified into these three groups. The religious feelings do not constitute a fourth group, or rather, they constitute a group in a different system of classification, whose basis is another characteristic than the function they have performed in the development of the race. One of the most puzzling questions for writers upon religious feelings has been that of the utility of the religious feelings.

Religious feelings are those feelings that accompany the perception or contemplation of God, in some one of his aspects. This is not an advantageous function of the feelings, and the religious feelings, as religious, have had no advantageous function in the development of the race. They are not grouped as religious because of any advantageous function, but because of the object whose contemplation arouses the feelings. The religious feelings, like every other feeling, have been advantageous, but they have been advantageous because the several religious feelings are either self preserving, community preserving, or race perpetuating. Every religious feeling may be classified into one or the other of these three groups.

Many of the most important religious feelings belong to the race perpetuating group. A good illustration may be found in the religious doctrine of immortality, which is closely related to the perpetuation of the self in the children. The strongest appeal that can be made for one to believe in the doctrine of immortality is the consideration of the death of a child. Not nearly so effective is the death of a parent or a sister or a brother, still less is that of a friend, while if the doctrine of immortality promised merely a resurrection and a continued existence of the individual in solitude, or in association with mere acquaintances or enemies, the doctrine would lose its attractiveness, and would be believed by few. But when one contemplates the reunion after death with a beloved child, it presents an irresistible appeal.

The figures of speech employed in describing and discussing religious experiences are largely those derived from family life. Father, mother, sister, brother, bride of Christ, and many others, are as appropriate in religious discussion as in family life.

The connection between religious experience and the phenomena of adolescence has been often commented upon and described. Adolescence is the time when the race perpetuating feelings begin to exercise a dominant influence in the life of the individual, and this is exactly the time that the most intense religious experiences occur. Much the larger number of religious conversions occur in the adolescent years. The ceremonies of confirmation take place in those churches that employ them just at the beginning of adolescence.

But not all religious feelings belong to the race perpetuating group. The attempt is made in our modern churches, at least, to justify religion on moral grounds, and to demonstrate that religion not only conduces to morality, but is inseparable from it. There is no doubt that some religious feelings accompany actions that are

altruistic, moral, and therefore, they belong to the community preserving group. All of those feelings that are emphasized by religion for the purpose of cultivating morality must be classified here.

Still others belong to the self preserving, or selfish group. Many persons and many churches emphasize the duties of religion as a means of obtaining entrance into Heaven and escaping Hell. Also, religion is practiced frequently as a means of obtaining the assistance of God in accomplishing any undertaking in the present life. All such hedonistic doctrines appeal to the feelings of the self preserving group.

Different religions and different churches of the same religion vary widely in the relative importance that they lay upon these different groups of the religious feelings. In its self preserving, community preserving, or race perpetuating function, with different individuals and under different circumstances, each religious feeling has without doubt been advantageous in the development of the race.

SYNOPSIS.

1—The purpose of classification is to show forth important relations among the objects classified which might otherwise be overlooked.

2—The most important classification of feelings is that which shows the functions that feelings have performed in the development of the race.

3—All feelings may be classified into three groups according to the functions that they have exercised; self preserving, community preserving, and race perpetuating.

4—The self preserving feelings accompany actions that tend to preserve the individual. They are called also egoistic feelings, and selfish feelings. They are especially dominant in children. Fear is one of them.

5—The community preserving feelings accompany ac-

tions that tend to benefit the community or some member of the community. They are also called altruistic, and moral feelings, although some of them, such as anger, hate and revenge, by a change of circumstances under which the community exists, have become vestigial and are considered immoral. Courage is a typical community preserving feeling.

6—The race perpetuating feelings are coordinate with the self preserving feelings. They accompany actions that tend to perpetuate the species. Three divisions may be recognized: sexual feelings, conjugal love, and philoprogenitiveness.

7—The religious feelings do not constitute a fourth group, but constitute a group in a different system of classification. Every religious feeling may be classified into one or another of the three groups of the self preserving, community preserving, or race perpetuating feelings.

CHAPTER VIII

THE PROBLEM OF ESTHETICS.

The esthetic feelings are those aroused by the contemplation of the beautiful or the ugly. They are commonly supposed to constitute a fourth group, distinct from the self preserving, the community preserving, and the race perpetuating feelings; and the problem of their functions in the development of the race has been a most difficult one for evolutionists to solve. So serious has this problem been felt to be that many persons not only look upon the esthetic feelings as furnishing the most incontrovertible evidence of the supernatural character of the human soul, but believe that there is no possibility of accounting for the esthetic feelings by any natural evolutionary process, such as accounts for the development of the physical organism. That the esthetic feelings may be accounted for only by the introduction of a miraculous element into the evolutionary process, is held by many scientific men.

The separation of the esthetic feelings from the other groups, and the assumption that they constitute an element in the affective life unrelated to any other department, has been the source of abundant error and much unjustified speculation. It is the purpose of the present chapter to show that esthetic feelings are not different in character from other feelings, but have their concomitants in the same circumstance by which other feelings are explained. Each feeling that accompanies the perception of an object that is adjudged beautiful or ugly, has its

concomitant in the resistance that the nervous impulse encounters in the process of perceiving. Esthetic feelings are subject to the same laws of habit and its consequent decrease in intensity, and manifest the same properties of specific character, intensity and tone as do other feelings. The principal reason for setting them off as a separate group has been the difficulty in understanding how they have contributed anything of advantage to the improvement of the race, and what function they have performed in racial progress. But when it is shown that the feelings recognized as esthetic have affiliations with groups whose utility and functions are already recognized, the difficulty vanishes, and it is seen that they constitute a group in a different system of classification, whose distinguishing character is not the function of the feeling in racial development, but a totally different characteristic. The esthetic feelings can all be classified into the self preserving, the community preserving and the race perpetuating groups. Their utility comes not in consequence of their being esthetic, but because they belong to the other three groups.

The assumption is generally made that there is some standard of beauty inherent in the human mind to which all objects that are adjudged beautiful must conform. Many different suppositions have been made concerning the nature of this standard. The curved line is supposed to be the line of beauty because it typifies the freedom which is the ultimate desire of the human soul. The utility which an object manifests is another standard, conformity to which is believed to render an object beautiful. If it is adapted perfectly to the performance of the work for which it is designed, then its contemplation affords esthetic enjoyment. Upon this view, the works of nature are beautiful, since they are perfectly adapted to the service for which God intended them.

There is beauty in the human form, and this beauty is

found in the close approximation that any particular human body makes to the standard that God has established. Man is made in the image of God, and the more closely he approximates the Divine Image, the more beautiful he becomes. But ornament is also beautiful, and beyond accentuating the elements of beauty that are indicated by some of the other theories, no reason can be suggested for the beauty of ornamentation.

An examination of the theories of beauty will show that there is no single one advanced which will explain the beauty in the different classes of esthetic objects, and scarcely any two theories fail to contradict each other. While one theory may be satisfactory for one class of examples which has suggested it and from which it is derived, it utterly fails when applied to others. Hence, also, there is no scientific theory of beauty, and science is generally considered as incompatible with an appreciation of the beautiful, and disposed to deny the importance of esthetics. Although the theories that are presented are largely discredited by scientific studies, they are still popular, and influential in a rhetorical way.

The same laws that have been applied to other feelings apply equally well to the esthetic. A thing that when seen for the first time is adjudged to be beautiful, becomes by custom unable to furnish the esthetic feelings, and may be reduced to the rank of the positively ugly. We see examples of this in musical selections and in the domain of pictorial art. To an uncultivated taste, a piece of music may afford the highest esthetic enjoyment, which after a greater musical experience will appear positively painful. The gaudily colored pictures of the tomato can and billboard type may be highly appreciated by an uncultivated and barbarous taste, but be a source of painful intolerance to one who is more artistically cultivated.

Anything that is exceedingly common is not considered beautiful, and fails to arouse in us a pleasurable

esthetic feeling. The indifference of the mountaineer to the beauties of his surroundings has often been remarked, and has been regarded as indicative of a low order of intelligence. But it should not be so considered, any more than should the failure of the critic to discover beauty in the flat prairies that constitute his home, nor in the common plants that make for him the weeds in his garden. Persons who are troubled every spring with dandelions in their lawns are able to discover beauties in the edelweiss which the dandelion does not disclose. The graceful fern is perhaps even less beautiful than is the ragweed or the mullein, but its beauty must be determined by its ability to arouse pleasurable emotion in those who view the different plants. The flat prairie is not more monotonous than is the ocean that has been the subject of so much poetical rhapsody.

The failure to see beauty in a common weed, or to discover that one's own dooryard is a panorama of scenic beauty, should not be regarded as an indication of a lack of esthetic appreciation, but the failure to experience esthetic pleasure in these too common scenes is merely another indication of the real nature of esthetic feeling and its affiliation with other groups.

The perception of common things has brought about such a condition of the brain cells involved that not a sufficient amount of resistance is engendered to accompany a pleasurable feeling, so we fail to appreciate the esthetic value. Ragtime, a street piano, popular songs, a hand organ, phonograph music—are all capable of furnishing quite as much pleasure to the ear of one who has not experienced a great deal of music as is the finest oratorio to the one who has spent years in musical study. The skilled musician was at one time able to appreciate the beauty of the hand organ or ragtime. When such was the case, classical music was anything but pleasurable to him. The simpler music furnished a sufficient amount

of resistance to accompany the pleasurable feeling, but, by habit, the resistance diminished and the feeling aroused ceased to have a pleasurable tone.

On the other hand, nothing is likely to be considered by us as truly beautiful that is altogether unknown and unrelated to something else that we have experienced. Such an object of contemplation is designated as the bizarre and ugly, and the esthetic feeling accompanying its perception has a painful tone. The ugly is as truly a subject for esthetic consideration as is the beautiful. The difference between the ugly and the beautiful is in the tone of feeling engendered by their contemplation. The ugly is something with which we are usually quite unfamiliar, and when we become acquainted with it, it ceases to be ugly, and the esthetic feeling accompanying the perception changes to one having a pleasant tone. The amount of resistance decreases, thus changing the tone of the feeling.

There is really little advantage in attempting to make a sharp definition of beauty, nor to delimit the esthetic feelings from the other groups. The definition of beauty will always involve a subjective element, and a thing will be beautiful to one person which is not at all so to another. Beauty can be defined only by means of the feelings which it arouses in persons, and the feelings vary in different persons according to experience, habit, natural constitution and pathological conditions. Any physiological condition that will modify feeling, will by the same process enter into the judgment of the beautiful. Hence it seems to be the case that there can be no absolute standard of beauty, and that the esthetic feelings are quite largely individual and subjective.

Esthetic feelings determine what shall be called beautiful. They resemble each other in the fact that they afford pleasure or displeasure, and are aroused by the mere contemplation of the objects that are thereby de-

scribed as beautiful or ugly. The feeling arises from the contemplation, not from the use that is made of the object contemplated.

In discussing the relations the esthetic feelings hold to each other and to the groups of feelings already described, we must first of all discriminate the esthetic from the pseudo-esthetic. Much of the feeling that we call esthetic is not truly so, but originates in another circumstance than the actual qualities of the object whose perception accompanies the feeling.

Very few persons will trust themselves to select a diamond from the stock of an unreliable dealer and decide upon the genuineness of the stone for themselves. This means that the person is unable to discriminate accurately the genuine from the false. The pleasure derived from looking at and owning the imitation ought to be exactly that which is derived from the genuine, but such is not the case. A person who takes much pleasure in owning and wearing a large diamond that he believes to be genuine, will lose much of the pleasure as soon as he learns that it is an imitation. Just the difference in the pleasurable feeling experienced in wearing the genuine and the imitation indicates the amount of feeling in such a case, that is pseudo-esthetic. In the example given, we shall see that nearly all the pleasurable feeling is pseudo-esthetic.

Much of the pleasurable feeling experienced in viewing a noted painting is pseudo-esthetic. The same thing is true in listening to the rendition of a musical number by some celebrated artist, or in reading some famous book. That the pleasurable feeling is largely pseudo-esthetic will be shown by the test previously employed. Let the famous singer be announced under another name, and the selection rendered be called by another title than that by which it is well known, and a large amount of the pleasure will be wanting. If the famous painting were unlabeled,

or the production attributed to an unknown artist, few persons would discover that it manifested great beauty, and a much smaller amount of pleasure would be experienced in looking at it. Just last winter, all expert critics of art in Detroit were unable to decide whether a picture of St. Augustine was worth \$600 or \$50,000. If it were painted by Murillo or Barbarelli it was worth the larger sum. But if not, it was comparatively valueless.

No one will be so rash as to assert that the pleasure derived from exhibiting the latest fashions, whether in the matter of clothes, furniture, houses, sports, or summer outings, is truly esthetic. If it were possible to establish an absolute standard by which each of these things might be judged, few would venture to assert that the latest fashions would more nearly correspond to it than did the ones which they displaced. If such a standard were established, not many of the fashionable things whose possession and exhibition afford so much pleasure would, in all probability, conform to it. The standard that is conformed to and by which the beauty of the article is judged is rather that of the reputably correct than the esthetically true.

The winding paths and sidewalks through a level lawn are supposed to represent a standard of beauty. What they really represent is the ability to spend money in a manner that is not economically productive. So the hand-made furniture, manifesting defects which are looked upon as evidences of the genuineness of the article, conforms to the standard of pecuniary display rather than to that of beauty. A photograph is or may be as artistically true as is the painting of the same scene. The preference for the painting depends not upon the esthetic value, but the pseudo-esthetic.

The same thing is true of archaic furniture and household utensils. The original owners of the brass candlesticks and high posted bedsteads could see little beauty

in them when the fashion changed. They were so common, that by continued seeing the nervous impulses accompanying their perception encountered little resistance. Now, that the objects are no longer common, relic hunters find in them a great deal of beauty. This appreciation of the archaic is almost altogether pseudo-esthetic, not esthetic.

No doubt the ancient Greeks thought their statuary beautiful. But if they had had an opportunity to examine modern statuary, it would not have been compared to their own so disadvantageously by them as it is by modern critics. Much of the admiration for Greek sculpture must be considered pseudo-esthetic and explained by the principle of the appreciation of the archaic.

The standard of beauty by which these pseudo-esthetic feelings are aroused is that of the reputably correct. This is, however, determined by several circumstances. It cannot be said that any one standard applies to all the numerous examples of things that are adjudged beautiful, but in nearly all cases it will be found that the ultimate standard is one that involves a conspicuous expenditure of money, or a conspicuous expenditure of time in a non-economic way. New clothes may not be more efficient nor more beautiful than the old, but the new represents the ability to spend money, while to wear the old might be considered as indicative of a desire to economize. Hence the new is to be preferred. The shine on a coat sleeve is perhaps not less beautiful than the shine on one's shoes, but much effort must be expended in keeping it off one and putting it on the other. So some articles of clothing are regarded as esthetic and beautiful that are detrimental to efficient labor, and the fact that it is impossible to maintain the clothing in proper condition while effective labor is going on is one of the elements in adjudging such articles of clothing as correct and beautiful.

This standard of beauty is a conventional one, estab-

lished by general consent, and the feelings aroused by the contemplation of objects conforming to it depends upon our association with other persons. New fashions; expensive ornaments; famous attractions of scenery, music, painting or architecture, would all lose much of their attractiveness were it not for the presence and judgment of other persons. The feelings are quite as real, and the pleasure therefrom is certainly as valid as if other persons were not concerned.

But all such feelings are capable of being aroused only in consequence of our association with other persons, and this is a sufficient mark of distinction to enable us to group them together under the name pseudo-esthetic. Since these feelings originate in the relation that we hold to other persons, we are justified in classing them with the community preserving feelings.

A different standard of beauty will be discovered in another group of esthetic feelings. Many persons regard little children as beautiful, and there are very few parents who are not susceptible to this kind of esthetic appreciation. So far is this kind of esthetic feeling removed from the pseudo-esthetic, that every parent regards his own child as most beautiful, even though the judgment of nearly every one else may contradict his own. The beauty of his own child that appeals to him does not depend upon its approximation to a standard that is reputably correct. A parent regards all children from a different esthetic standpoint than does one who is not a parent, or one in whom the instinct of philoprogenitiveness is not strongly developed. The judgment of beauty and the esthetic feeling accompanying the perception of an object of this kind must be associated with the group of the race perpetuating feelings.

To the same group belongs the judgment of beauty and its accompanying feeling that arises from the contemplation of the lover of the opposite sex. Here if anywhere

there is no accounting for tastes and the judgment of beauty is of the most diverse character. There is probably no woman who is not the most beautiful woman in the world to some man, or who does not possess the proper qualifications to make her so regarded.

Much of the beauty that is discovered in dress is associated with this fact, and the accompanying feelings belong to the race perpetuating group. Men and women differ in mental and physical characteristics, and in some qualities that appear to be so subtle as to defy description. Ornamentation of dress that seems to accentuate these differences is adjudged to be beautiful, and is attractive to persons of the opposite sex. Only such an explanation as this will account for the padding of the coat shoulders in men, and the equally pronounced padding of the hips and bust in women. Nearly every characteristic of women's dress that is adjudged to be appropriate for the most formal occasions may be accounted for, first by the accentuation of the feminine characteristics, and secondly by its manifesting conspicuous expenditure of money. The feelings that are aroused by the one element of beauty belong to the race perpetuating group; and those that are aroused by the other to the community preserving group.

Two different classes of feelings belong to the egoistic, or self preserving feelings, and two different standards of beauty are employed in judging of objects whose contemplation arouses the feelings. Some objects are judged to be beautiful because of the utility they manifest. In times of distress or need, the object that assists us out of our difficulty will never be thought of as ugly, no matter what it may be. The thing which is recognized as being perfectly adapted to the purpose it is intended to serve will be adjudged beautiful, and arouse in us the esthetic feeling. This is the esthetic feeling that is experienced when examining a delicate piece of machinery, such as a watch or a highclass microscope, a locomotive engine, or

an X-ray machine. In all such cases, it is the perception of relations, not merely of the objects, that accompanies the esthetic feelings. This is the source of esthetic appreciation that is experienced in studying the natural adaptations manifested so abundantly in animals and plants. Few persons have ever examined carefully the mechanism employed in the distribution of the pollen of the mountain laurel, (*Kalmia*) or the numerous devices which contribute to the reproduction in the ragweed, (*Ambrosia*) or the adaptive mechanisms in the giant water bug, (*Belostoma*) without experiencing this kind of esthetic enjoyment.

While some writers upon esthetics assume that this principle of utility is the universal principle of beauty, there are many persons who assert that such illustrations as are here adduced are not examples of beauty and esthetic appreciation at all. It may perhaps be properly a question whether they come under the head of esthetics, but whatever the feelings may be called that are aroused by the contemplation of such objects as the mechanisms of the ragweed, *Belostoma*, and *Kalmia*, they belong to the egoistic, or self preserving group. Personally the writer is inclined to describe them as esthetic of the most pronounced character.

Occasionally this kind of judgment of the beautiful conflicts with that which belongs to the community preserving, or pseudo-esthetic group. The winding sidewalks through a level lawn cannot be considered beautiful when judged by the standard of utility. Their beauty is determined by the pseudo-esthetic standards, and in this case it is especially the pecuniary standard of conspicuous expenditure. But when a person is able to demonstrate his ability to spend money in unprofitable ways more emphatically than this would indicate, it is very likely that his standard of beauty will demand straight sidewalks. So while the moderately wealthy are likely to appreciate

the beauty of outside ornamentation of their dwellings, the excessively rich are as likely to find more beauty in a mansion that is severely plain. The gingerbread Queen Anne architecture appeals only to persons in a certain stage of pecuniary culture. The same thing will account for the attraction that mission furniture has for those who are notoriously able to spend money, so that there is no probability that they adopt mission furniture for the purposes of economy, although it has an added attraction of novelty in the fact that it is not the usual furnishings of the house in which most of those who admire it have been reared.

The other group of the esthetic feelings that must be classed with the self preserving, or egoistic, is that which involves directly the activity of the senses. This is the esthetic feeling accompanying the perception of the rainbow, or wild flowers, or scenic beauty that is not that of some noted locality such as Niagara Falls would be. This is the true, genuine, esthetic feeling, accompanying the play activity of the senses, and which justifies more nearly than any other esthetic feeling, Herbert Spencer's determination of the association of esthetic activities with play.

Thus the esthetic feelings fall naturally into the three groups whose functions have been already described, and there is no necessity for establishing a separate group to include them. We see also that it is impossible that there shall be any single standard of beauty, or any single principle to which all judgments of what is beautiful must conform. There is no single type of esthetic feeling, but there are as many kinds of esthetic feelings as there are standards of beauty. We have described two kinds that belong to the self-preserving group, two that are affiliated with the race perpetuating group, and one, two or many that have affiliations with the community preserving group, and which we have called the pseudo-esthetic.

Each particular type of feeling will have its own standard by which the beauty of the thing whose perception accompanies the esthetic feeling will be judged.

It remains for us to show the function that the esthetic feelings have had in the development of the race. Our fundamental proposition is that every feeling has now, or has had in the recent past, some function that has inured to the benefit of the individual or of the race. Although the esthetic feelings have been shown to belong to the several groups whose function we have been able to demonstrate, yet it is necessary in case of the esthetic feelings, to show how they may in themselves have been advantageous.

The suggestion of Herbert Spencer, that the esthetic feelings have their origin in play, furnishes a key to the understanding of the whole situation. While only that group of esthetic feelings that constitute one of the two divisions belonging to the self preserving feelings can be truly called play, yet the demonstration of the utility of play will explain for us the whole function of esthetics. An explanation of the esthetic functions can be afforded only by some kind of a physiological or biological hypothesis.

Let us suppose that of the seven hundred million or more brain cells, three hundred million of them are involved in the experiences that occur in the ordinary activities of the human being. Every activity that preserves the individual, performs the functions of society and perpetuates the race, demands the transmission of impulses through some combination of cells in the three hundred million. The other four hundred million are lying fallow and undeveloped. If, now, some experience should be brought about that would involve some of the new and undeveloped cells, the resistance encountered in the new combination would be pleasurable, if not too intense, and the cells previously undeveloped would be brought into

activity. We might call the activity play, and the accompanying feeling esthetic.

A nervous impulse demands the liberation of some amount of nervo-motive force, and is itself the best evidence of the force which is liberated. The probability is that the nerve force is liberated in the developed cells. The katabolic processes that liberate the energy occur in the cell bodies. While it is possible that the nerve force is liberated in some other elements of the brain, few physiologists are likely to question the statement that it is liberated in the developed neurons. Neurons become developed in consequence of their exercising activity which is manifested by the oxidation of their tissues and its sequential restoration, and the transmission of impulses through them.

Granting the validity of this speculation, it follows that the esthetic feelings accompanying the resistance encountered in transmitting impulses through combinations involving cells belonging to areas that we have called fallow, will call into action and demand the development of cells that otherwise would never become functional.

The hearing center in the brain becomes developed by means of hearing sounds incident to every day life. As a result of such experiences, only a small part of the number of cells in the hearing center would ever become developed. Music involves a much larger number of sounds and sound combinations than would ever be experienced by a person without musical training. Hence it is that the hearing center of persons with a wide musical experience would contain a much larger number of developed neurons than would the hearing center of the same person if he had never had the musical experience.

The same thing may be said of the esthetic feelings accompanying the activity of the sense of sight. Every new thing seen encourages the development of a large

number of cells, and in esthetics, new things are to be looked at. Only things more or less new are capable of arousing the esthetic feeling. Novelty and something different are always conditions of the esthetic feeling. It must not be too new, too novel and unrelated, or the effect will be painful and the esthetic advantage will be lost.

Esthetic experiences, then, permit and encourage the development of neurons that would otherwise never become functional. In the developed neurons, nerve force is generated, tissue is oxidized, and the esthetic experiences are likely to result in liberating a considerably greater amount of nervous energy than would be possible were it not for the neurons developed by them. The greater amount of energy liberated in the brain, the better will all the mental functions be performed. So we have from the esthetic experiences and the esthetic feelings which accompany them, a direct and an indirect advantage in the growth of the species and the race.

This does not mean that in any particular case, a person who has an esthetic appreciation will be capable of generating a larger amount of nervous energy than will another particular individual who has not such esthetic experience; but it means that the person who has had the esthetic experience will be capable of generating a larger amount of nervous energy than that same person would be able to do if he had not had the esthetic experience. In the aggregate, then, the esthetic experiences favor the development of nervous energy and intellectual power. The persons and the nations who have the highest esthetic appreciation, will, other things being taken into account, be able to accomplish the greater amount of intellectual work, and be the best fitted to survive in the struggle for existence.

Our theory will show why it is that only the pleasurable esthetic feelings can be serviceable, and why there is the disposition to limit the field of esthetics to the pleasant

feelings. A painful feeling is the accompaniment of a resistance greater than is beneficial to the cell or to the organism. If the resistance is great, the tissue will be used up faster than it can be restored, and the final result will be injurious. Hence it is that the painful esthetic feelings, those which accompany the judgment of the ugly, are not helpful to the growth of the neuroblasts, nor to the development of the greater energy than would be liberated in the absence of the esthetic experiences.

SYNOPSIS.

1—Esthetic feelings are those which accompany the perception of an object that is judged to be beautiful or ugly.

2—It is unnecessary to establish a fourth group for the esthetic feelings, since all of them may be distributed among the self preserving, the community preserving, and the race perpetuating groups.

3—Pseudo-esthetic feelings are those arising from the contemplation of objects which are judged to be beautiful according to a standard established by society, or the community as a whole. They belong to the community preserving group.

4—There is no single standard of beauty to which all objects can be made to conform.

5—The truly esthetic feelings are those arising most nearly from the exercise of the senses. Such activities conform most closely to the definition of play.

6—Esthetic feelings afford the same advantage that comes from play. They assist in the development of a larger number of neurons than would otherwise become developed, and so favor the liberation of a greater amount of nervous energy.

CHAPTER IX

THE RELATION OF FEELING TO INTELLECT.

It must be evident from what has already been stated that there is a very close relation between the intellectual process and feeling. They are not separated in time, nor is there a sequential relation between them. The relation is not that of cause and effect, for feeling cannot be considered the cause of the intellect, nor the intellect the cause of the feeling.

Many writers upon psychology have regarded feeling as an obscure, weak, indefinite intellectual process, or a process which when it becomes clear and definite is intellect. Intellect is thus regarded as having its origin in feeling, and changes from feeling to intellect by becoming definite and clear. Even some of our most prominent psychologists of the present day are inclined to consider the essential difference between intellect and feeling as one of clearness. They would say that intellect grows out of feeling through a process of attention.

Such a theory would explain nicely the reciprocal relation between intellect and feeling, and would permit a satisfactory explanation of the specific differences in feelings; but it utterly fails to explain the whole series of phenomena in which there is manifested a direct relation between feeling and intellect, nor can it by any possibility account for the fact that feeling may be intensified by a process of attention. It is a hypothesis that can be justified only by neglecting a large number of the facts.

To the psychologists who have regarded intellect and feeling both as activities of a self active entity, the rela-

tion has naturally appeared to be not a very close one. The mind could work in one way or it could work in the other as it pleased. However, that mind which had most power in one direction was very likely to have a correspondingly large power in the other. Hence we find the older psychologists emphasizing the fact that whatever the relation between feeling and intellect might be, whenever we found a man who manifested a great deal of one, we were likely to find him also manifesting much of the other. Quotations from two popular elementary textbooks of twenty-five years ago will clearly illustrate the general opinion among psychologists of that day.

"The relation of the sensibilities to the intellect is easily understood. An act of the sensibilities is usually preceded by one of the intellect. . . . The strength of the feeling is usually proportional to the strength of the intellect. When the cognition of the intellect is deep and vivid, the feelings arising will be strong and vivid." (Brooks, *Mental Science and Culture*.)

"The range and power of the sensibilities, the mind's capacity for feeling, depends upon the range and vigor of the intellectual powers. Within certain limits, the one varies as the other. The man of strong and vigorous mind is capable of stronger emotion than the man of dwarfed and puny intellect." (Haven, *Mental Philosophy*.)

It can be seen how naturally a writer who considered feeling and intellect as a manifestation in different direction of the power of a mind should regard the two as directly related to each other. No connection of a causal nature could be imagined, but the mind manifested its strength in one direction as certainly as in another.

The larger number of psychologists of recent years have emphasized the difference between intellect and feeling rather than the similarity. It is a common expression to speak of the opposition between the head and the heart, and the meaning of this extraordinary physiological as-

sumption is that feeling and intellect have some kind of an opposing relation to each other. It would seem, however, that the opposing relation is not one of reciprocity, but one of direct conflict in determining a course of action. The opposition is very different in its nature from that which is obtained from a rational, physiological interpretation of feeling.

The fact has already been mentioned that many physiological psychologists are inclined to assume a separate system of end organs, nerve carriers, and brain centers for feeling from those that are involved in the intellectual processes. Especially is this true for the feeling processes of the simplest kind, the physical feelings that accompany sensations, the affection proper. The assumption of end organs and brain centers for physical pain, and its discrimination from mental unpleasantness is a manifestation of this tendency. Nearly all psychologists who consider all physical pain as a sensation, regard feeling as obscure and indefinite intellect. The latter opinion has in all probability influenced the adoption of the former. However, it seems safe to predict that such a tendency is not likely to proceed much farther than it has already gone.

Among the new psychologists, however, there are two radically different opinions concerning the relation between intellect and feeling. The one regards them as so related that one varies with the other. Gardiner, in a review of Sollier's book, *The Mechanism of the Emotions*, rather laments the fact that Sollier considers that emotion is at the expense of effective intellectual work. This opinion of Gardiner, shared by many present-day psychologists, has a different origin from the same opinion held by the psychologists of twenty-five years ago. It is supported by observation rather than theories, although the observations are interpreted in an unsatisfactory

manner. A true interpretation will show that the observations do not warrant such a conclusion.

But there are not wanting psychologists who hold that the two processes are closely related, and that the relation is a reciprocal one. Thus Ribot says "It is highly probable that in the state of surprise we have imperfect knowledge because we have too much sensation." (*Attention*, p. 25.) The context shows that by this use of the word sensation the translator means feeling. And so Höffding remarks, "Cognition and feeling must thus stand in inverse relation to each other. The more strongly one is manifested, the less strength is at the command of the other." (*Psychology*, p. 98.) And again (p. 232): "In respect of strength they [feeling and sensation] stand in inverse relation to each other, so that the stronger the feeling becomes, the more the properly sense-perceptive, or cognitive element disappears."

Spencer, (*Psychology*, Vol. I, p. 478) recognized the same fact. He says "These several expositions, I think, make it clear that cognition and feeling, throughout all phases of their evolution, are at once antithetical and inseparable."

Whatever may be the relation between feeling and intellect, we may be very sure that a corresponding relation exists between their physiological concomitants. If we can determine what the concomitants of the two processes may be, we shall have a means of describing and picturing in understandable terms the relation between intellect and feeling.

We have based our whole interpretation of feeling upon the hypothesis that it has for its physiological correlate the resistance that a nervous impulse encounters in passing through a nervous arc. In the process of perception, sensation, act of reasoning, or judging, an impulse must pass through some combination of brain cells. If we consider the passage through the arc as the concomitant of

the intellectual process, and the resistance that the current encounters as the concomitant of feeling, we have an easy way of picturing the relation between the two processes, and our theory corroborates the observations of those persons who conceive the two processes to be reciprocally related.

The greater the amount of nervous energy that passes through the arc, the greater the amount of intellectual work that is accomplished. From this hypothesis there will be little dissent, for the conception is a common one. Every observation of the learning process confirms it. Every theory of learning, interest, exercise, attention, good health, constant study, all of them are partial applications of this hypothesis, and arise from a consideration of only one factor in the determination of the amount of nervous energy that is transmitted.

The effect of resistance is to stop out part of the current and to diminish the amount that succeeds in passing through the arc. The greater the portion of the nervous current that is stopped out by the resistance, the greater the amount of feeling that will be experienced, and the smaller will be the portion that remains for the doing of intellectual work. This is the general law, and no exception will be found when the law is properly stated.

The relation is quite similar to that of the ohm and the ampere in an electric current. It must be remembered, however, that this is merely an analogy, and must be modified very much before the ohm can be considered as an accurate illustration of the resistance in a nervous current. Likewise the conception of ampere must be decidedly changed before it can be made to apply to the element of the nervous current that corresponds to the intellectual process.

We may state the law that subsumes the relation between intellect and feeling, in something like the following manner: (a) With a given amount of nervous en-

ergy, the greater the feeling, the less the amount of intellectual work that will be done. (b) With a given amount of nervous energy, the less the feeling, the greater the amount of intellectual work that may be done.

In the above statement of the first law of feeling, we have assumed that the amount of nervous energy remains the same throughout. The resistance then, depends upon the condition of the nervous conductor in which it is encountered. But there are two variables in the measurement of resistance, and they vary independently of each other, which makes the calculation of their resultant difficult. The other variable factor is the amount of nervous energy, and this necessitates the statement of a law especially applicable to it. The second law of the relation between feeling and intellect may be stated as follows: With a given nervous arc, the amount of feeling and of intellectual work will vary with the amount of nervous energy. With a given nervous arc, the greater the amount of feeling, the more intellectual work will be accomplished; and with a given nervous arc, the less feeling, the less intellectual work that may be done.

Here it seems as if we had two laws that are contradictory to each other, and this is the explanation of the contradictory interpretations and theories of feeling that have been entertained. The amount of feeling that is experienced, and the relation between the amount of feeling and the intellectual work that may be accomplished at any time is the resultant of these two contradictory laws. However, the two laws, when properly understood will be seen to be statements of the same law: to wit, The relation of feeling to intellect varies directly as the strength of the current and inversely as the resisting power of the nervous arc.

There is also a third variable, mentioned in chapter IV that produces confusion in observation, and sometimes conceals the effect of the general law. This variable

is attention, which will be considered in a subsequent chapter, and it is possible that an explanation of some of the phenomena growing out of the relation between feeling and intellect will have to be deferred until that discussion is reached.

Let us look at some of the illustrations of the first law of the relation in which the nature of the conducting arc is considered the variable. We find that it is impossible to do very much intellectual work of any kind when we are experiencing much feeling. A toothache is never conducive to study, nor is the time just before dinner the best hour in the day for attacking difficult lessons. A cold room or an exceedingly hot day are neither of them satisfactory conditions for the best work of students. Anything that causes us to experience considerable feeling is far from being helpful to study.

Quite as serious as physical pain is the existence of a series of circumstances that induce mental unpleasantness. An angry man cannot tell whether he is eating boiled cabbage or stewed umbrellas. The serious illness or death of a beloved relative or friend is totally destructive to our ability to study, or to do much intellectual work of any kind.

Misfortune in any direction, in business, financial affairs, family relations, the disappointment of our ambitions—any and all of these things are sufficient to distract us, which means that we are thereby rendered incapable of exhibiting our usual intellectual acumen, seeing what is best to do, judging wisely, acting up to our best lights.

“A man who pleads his own case in court of law has a fool for a client.” This saying is a blunt recognition of the fact that a man who is in such difficulty as to have a case in court is not capable of judging what is best to be done, and that a lawyer who feels the situation much less keenly is cheap at half the money. That a physician

will not treat the members of his own family, but calls in some other physician when one of them is sick, does not imply that he lacks faith in the efficacy of his own medicine, but that he is unable to exercise his best judgment concerning the course of treatment. A man is never the best judge of his own case and that merely because he experiences too much feeling. He may be a good adviser for some one else, but he is likely, if he experiences much feeling, to make serious errors in deciding what is best for him to do. This is in keeping with the statement that we are often very much influenced by our feelings. We fail to do what is best because the feelings that we experience obscure our vision, and the proper thing for us to do does not stand out in the clearness that is necessary for it to eventuate in proper action.

It is a recognition of the reciprocal relation between feeling and intellect that lies at the basis of the demand that a judge shall not be an interested party in any case that comes up for trial in his court. It is no reflection upon his honesty that makes it necessary for him to resign his place, but a practical recognition of a psychological fact.

Less influential, but still serious, is the pleasant feeling that we experience. Sometimes we are too much enraptured to make the best intellectual judgment. The receipt of good news, such as might be the fact that we had suddenly fallen heir to a million dollars, or our appointment to a much desired or lucrative position, or an invitation to take a longed for journey—any of these things that engender pleasant feelings of a rather high degree of intensity, is destructive for a time of our ability to apply our intellectual energies to the learning of lessons or the solving of problems. Even the curiosity manifested in taking up a new subject of study is likely to interfere with its mastery until the feeling of newness, curiosity, and wonder has disappeared. Feeling, no matter whether

it is pleasant or unpleasant, is detrimental to the work that it is possible for us to do.

It is true that pleasant feelings are less destructive to the intellectual work than are painful feelings, or perhaps it would be better to put it the other way and say that painful feelings are more detrimental to intellectual work than are pleasurable feelings. The reason for this will appear in our explanation of the difference between painful and pleasurable feelings. As a general rule, painful feelings are the concomitants of resistances of a greater degree of intensity than are pleasurable. An increase of intensity up to a certain point increases the pleasurable feeling, beyond which point the feeling comes to have a painful tone. The painful feeling is the concomitant of a greater resistance, and tends to stop out a greater amount of the nervous energy, rendering a smaller portion of it available for doing intellectual work. The very best intellectual work will be done with the least fatigue, when there is no feeling accompanying the process. Any kind of feeling, pleasant or unpleasant, is detrimental to doing the greatest amount of work with a given amount of energy. Here we have another example of the law of habit. Only those activities that are done as the result of incessant practice are done as well as they may be. It is the inevitable psychological law that feeling detracts from the possibility of doing the best intellectual work.

Habit not only decreases resistance, and diminishes feeling, but it increases the amount of work that can be done by the expenditure of a given amount of energy. We are inclined to put as our best illustrations of habit the doing of some muscular act. But mental habit is just as important and as readily observable as is muscular habit. The work of learning a column of the multiplication table demands the expenditure of a considerable amount of energy, and is ordinarily accompanied by a feeling having a painful tone. But after a number of

repetitions, the lessons can be repeated with the expenditure of much less energy, and with actual pleasure, or no feeling at all.

The reciprocal relation between feeling and intellect may be well recognized in the processes of children. Children are tremendous generators of energy. The plasticity of their tissues, the rapidity of the changes that occur in them, the fact of growth which is itself dependent upon the metabolic changes of which the liberation of energy is one effect—all of these things indicate how great is the amount of nervous energy that little children generate. Growth itself is an indication of the development of much nervous energy. Growth of any tissue would, if not stopped entirely, be at least very much retarded if the generation of nervous energy at any time were to be impaired or diminished. If any organ in the body is deprived of its supply of nervous energy, such as would result from the cutting of the nerve that leads to it, that organ would become paralyzed and soon atrophy.

The tremendous activity of children manifested in play is indicative of the liberation and expenditure of a large amount of nervous energy. But children are capable of little intellectual work. One would suppose that with the amount of nervous energy available, little children would be able to do much, but its universality is such that the little capacity of children for intellectual work excites no comment.

We have already recognized the fact that children are creatures of feeling, crying or laughing, rejoicing or sorrowing, almost all the time. We know, too, that the brain cells and centers are relatively lacking in organization, and that the reaction time of children is slow. We must understand then, that much resistance is encountered by a nervous impulse in passing through a nervous arc in children, and that a large expenditure of energy, lost in feeling, is necessary to overcome the resistance,

with the result that a relatively small amount of it gets through. We have, then, a sufficient explanation of the fact that little children are capable of doing little intellectual work. The resistance in this case is due largely to the character of the nervous arc, and this is the condition in which the reciprocal relation between intellect and feeling is shown.

We found reason in our chapter on the Problem of Esthetics to believe that the esthetic feelings have, on the whole, been advantageous in increasing the amount of nervous energy available for doing work. But there are indications that not in all cases does a highly developed artistic and esthetic sense contribute anything whatever to the amount of intellectual work which a person is capable of doing. In fact, an examination of the work that is done by artists in any branch of esthetics will lead one to suspect that art is a deviation from the normal, and it may be so to such an extent as to seem almost pathological. Nordau has maintained that art is the slight beginning of a deviation from perfect health. Very few of the great artists have lived lives that were in all respects commendable, and their intellectual work has partaken of the erratic character and irresponsible nature that their social lives have manifested. We have in these two series of facts a situation that needs to be harmonized and brought under one law.

The latter statement, that artists manifest a deviation from the ordinary and a deviation in the wrong direction, is better established than the other; namely, that esthetic feelings have been advantageous to the development of the race. But we can see that the two series of observations are not irreconcilable nor necessarily opposed to each other. The artist who leads a life of feeling, and expends his nervous energy in overcoming resistance, it not likely to contribute very much to the intellectual life of the race. He may, as a result of his esthetic development, become

able to generate a larger amount of nervous energy than he would otherwise do, but if he expends all of this surplus energy and a portion of that besides which would not be so expended if he were not an artist, he will have his intellectual output diminished as the result of his esthetic cultivation. The amount of nervous energy will be increased, but the amount used up and expended in overcoming resistance will be still further increased. Hence the net result of his intellectual work will show not an increase, but an actual decrease below the normal amount that might be expected from him. This explanation will satisfactorily account for the fact that while we ought to expect great artists to accomplish more intellectually than ordinary men, only a few of them do so. This will indicate the limitation that must be set also, upon the artistic cultivation of the individual, if the greatest intellectual development is to be attained.

So far, all of our illustrations have been of the kind that show the reciprocal nature of intellect and feeling, but there are facts that would seem to indicate the contradictory relation. Why is it that some men, who are capable of intellectual work that is unquestionably great, are at the same time men of deep feeling? Abraham Lincoln is a good example. So many instances of this kind may be cited that it is no wonder that many persons have been misled into the belief that instead of there being an antithesis between intellect and feeling, the two work with each other. The poet says:

"It is the heart and not the brain
That to the highest doth attain."

The explanation of the discrepancy is easy, and both may be brought under one rule of the relation between feeling and intellect. We have but to recall that the resistance, as we are using the word, varies with two fac-

tors, the nature of the nervous arc and the strength of the current. In all cases of men who are intellectually great, and still manifest much feeling, we have the generation of a large amount of nervous energy. Such men are genuine steam engines for the generation of nervous energy, and their very appearance is frequently indicative of that fact. There is a wide difference in persons in the amount of nervous energy they are capable of generating. A person who generates twice the amount of energy that another does, is able to expend a large amount of it in feeling and still have an excess of energy over the first to employ in doing intellectual work.

However, if any one of the men who might be cited as examples of deep feeling, and still intellectually great, had employed all his energy in intellectual work, letting none of it be destroyed in feeling, the intellectual output would greatly have exceeded that which was shown. It will be understood that our employment of the quantitative expression, referring to nervous energy, is altogether figurative, and not intended to be anything more than an illustration to make the meaning clear.

Another series of examples like the last finds its explanation in the same condition. As students in school we are advised to manifest interest in our studies, and whatever our work may be, we are assured that we shall do it better if we are interested. Interest, in the meaning given to it by the persons who furnish the advice, means a feeling of a pleasant tone. The command, then, is to experience more feeling in our work if we wish to do our work better. This advice, apparently so conformable to the facts observed, would seem to indicate that feeling and intellectual work vary together, and are not reciprocally related.

One group of educational philosophers regards interest as the most fundamental condition of successful education. No school exercise in which children are not in-

terested can have any educational value for them. Hence it comes about that the cultivation of interest, the experiencing of a pleasant feeling, is the *sine qua non* of education. The errand boy is subject to reproof because he fails to experience interest in his work.

When we experience interest in our work, we expend energy in overcoming resistance. But if the resistance arise from the larger amount of energy generated, we may still have a very considerable surplus to employ in doing intellectual work. If the pleasurable feelings were to arise from any other circumstance than the increase in the amount of energy, the result would not be advantageous, but rather the reverse. The command to be interested in our work, then, is really a command to "Go thou, and generate more nervous energy."

This condition of interest is advantageous only so long as the resulting tone of feeling is a pleasurable one. If it is a painful tone, such as may be the case when overstimulation results in worry, the result is disastrous. But the larger amount of nervous energy generated and transmitted through the nervous arc, actually results in the more rapid modification of the nervous conductor and the more rapid growth of the cells, neurons, dendritic branches, and association fibers. Hence the most favorable condition for educative processes is that in which there is generated a large amount of nervous energy, so large that its transmission involves that degree of resistance indicated by a pleasant feeling, and accompanied by positive attention, whose effect is to transmit the impulse with the least resistance. By a process of positive attention it is possible to send a large amount of nervous energy through a brain center with a force only great enough to overcome the resistance. It is this attention factor that the "Interest" people usually omit, or fail to take into proper consideration.

Thus it will be seen that the doctrine of interest is not

at all contradictory to the determination of feeling as the concomitant of resistance, but that, when properly understood, it furnishes an excellent corroboration of it. We can tell when we have generated more energy by the increased feeling that we experience, and the increase in energy may also be proved to exist by the greater quantity of blood that is sent to the brain and the greater amount of tissue oxidized.

When we say that we have a sufficient explanation of the fact, it is necessary to avoid the implication that we have explained and understand how it is that a nervous impulse in passing through a nervous arc is a constant accompaniment of an intellectual process, nor have we explained why it is that resistance to transmission is a constant accompaniment of feeling. But it is meant that we have associated the intellectual and the affective processes, which we do not understand, with a physiological process and the nervous state which accompanies it. The remark of H. Newell Martin is very much to the point here: "We do not know at all how an electric current sent around a bar of soft iron makes it magnetic. We only know that the one change is accompanied by the other. But we say that we have explained the magnetism of the piece of iron if we have found an electric current circulating around it. Similarly we do not know how a nervous change causes a mental state, but we have not explained the mental state until we have found the nervous state associated with it, and how the nervous state was produced." (*Human Body*, p. 462.)

SYNOPSIS.

1—With a given amount of nervous energy, the greater the feeling, the less intellectual work will be accomplished; and with a given amount of nervous energy, the less the feeling, the more intellectual work will be accomplished.

2—*With a given nervous arc, the greater the feeling experienced, the more intellectual work will be done; and with a given nervous arc, the less the feeling, the less intellectual work will be accomplished.*

3—*Attention presents a third condition that may modify either feeling or intellectual work.*

4—*Interest in our work is advantageous, if by interest we mean a pleasant feeling, and if it is the concomitant of increased resistance arising from the liberation of a greater amount of nervous energy.*

5—*Habit by decreasing resistance and its concomitant feeling enables a greater amount of intellectual work to be done with the expenditure of a given amount of nervous energy.*

6—*Children experience much feeling as a consequence of liberating much nervous energy which is directed through poorly organized brain centers. There is much resistance from a summation of both conditions.*

CHAPTER X.

THE RELATION OF FEELING TO CONSCIOUSNESS.

The entire matter of consciousness is in a more confused and disordered state than that of almost any other division of psychology. The confusion arises largely from the use of the word consciousness in two distinct senses, with a strong tendency to adopt the one that is least to be commended. The first use of the word means a knowledge of our own mental states and processes that are in progress at any one time; or we may mean by it the process by which our mental states become known; or the property of a mental process by which it becomes known to us. Any of these descriptions is indicated by the word awareness to discriminate it from another use of the term.

This is the common meaning for the word. When we speak of losing consciousness, we mean that we cease to be aware of the mental processes that are going on. We are unconscious when we are asleep, and when we awaken we become conscious. Chloroform brings on a condition of unconsciousness, and equally effective in producing the same result is a blow on the head. Unconsciousness may be produced in many ways, and the difference between consciousness and unconsciousness is always the same.

But another meaning for the word consciousness has come into very general use among psychologists, and by it is meant any kind of a mental process that may be experienced. It is used as a synonym for mind, and psychology is often defined as the science of consciousness. Any mental process is a state of consciousness, and when consciousness is wanting there can be no mental process of any kind.

A critical examination will show that the meaning of awareness is the primary use of the word and the second meaning is derived from the first by a figure of speech. When we say that every mental process is a state of consciousness, we are compelled to employ the word with the first meaning. The argument used to justify this use of the word is that there can be no mental process without awareness, or of which we are unconscious, or without consciousness. From this arbitrary assumption psychology is defined as the science of consciousness.

It would be equally possible to show that every mental process is accompanied by feeling and, therefore, every mental process is a state of feeling, and psychology may be defined as the science of feeling. Or it might be shown that every mental process is accompanied by muscular movement, therefore, every mental process is a muscular movement ("All consciousness is motor") and psychology may be defined as a state of movement or behavior. Or it might be shown that every mental process is accompanied by attention, therefore, every mental process is a state of attention, and psychology may be defined as the science of attention; or, that every mental process involves an act of will, therefore, every mental process is a state of will, and psychology might be defined as the science of will. Any one of these statements has the same kind of justification or lack of justification, as has the definition of a mental process as a state of consciousness.

The second use of the word grows out of the arbitrary doctrine that no unconscious process can be mental, and such unconscious state does not constitute a proper subject for discussion in psychology. Those who employ the second meaning of the word assert that there is no difference between a sensation and the consciousness of a sensation, and that an unconscious mental process is a contradiction in terms. What should be stated by those psychologists who assert that every mental process is a state of

consciousness is that every mental process is accompanied by consciousness, or that every mental process is a conscious state. Instead, for example of defining memory as a state of consciousness, having specified characteristics, these writers should say that memory is a mental process having the specified characteristics and accompanied by consciousness. This is what is really intended, and the usual form of defining a mental process as a state of consciousness substitutes the differentia for the genus.

This employment of the word consciousness with the second meaning is attributed to Descartes, who argued vigorously for the identity between a sensation and the consciousness of a sensation. His argument was designed to furnish a means of discriminating the mental processes of man from that of other animals, and he used it as a postulate in his argument that animals are automata.

Locke defined consciousness as the perception of that which passes in our own minds, (Bk. I, Ch. 1) but he also insists that there can be no mental process without consciousness. He uses such expressions as "—hard to conceive that anything should think and not be conscious of it."—"For to be happy or miserable without being conscious of it seems to me utterly inconsistent and impossible." (Bk. II, Ch. 1, Sec. 11.)

Hamilton is generally credited with using the word in the first sense, for he defines consciousness as "The recognition by the thinking subject of his own acts and affections." But he also sees no inconsistency in saying that "A feeling of which we are not conscious is no feeling at all" (*Metaphysics*, p. 125). But a tabulation of all the expressions involving the employment of the word consciousness shows that Hamilton habitually uses the word in two senses.

Notwithstanding the fact that no one has yet been able to use the word in the Cartesian sense without involving himself in contradiction, and that in defining a mental

process as a state of consciousness one necessarily employs a *petitio principii*, the influence of Wundt and Ziehen has been sufficient in this country to make this use of the word the common one, even among physiological psychologists. Ziehen is particularly emphatic. He says: "Let us repeat it—psychical and conscious, are for us, at least at the beginning of our investigations, identical" (*Physiological Psychology*, p. 5). And again: "From the outstart, the conception unconscious psychical process is an empty conception" (p. 5). "Consciousness is merely an abstraction. The association of ideas with its accompanying sensations and images is consciousness" (p. 29). Even Höffding says: "The strictly psychological standpoint is confined to the phenomena of conscious life. We know directly just so much of the mental life as we know of the phenomena of consciousness" (*Psychology*, p. 23). But he does not hesitate to refer to the sensations and perceptions that are experienced unconsciously, and the elements of mental life that grow out of the unconscious.

If we employ the word in this sense, we must assert that the producing of Kubla Khan was not a mental process; that the phenomena of dreams do not belong to the psychic life; that the thousand and one adjustments, sensations, judgments, and decisions that constitute the larger part of our daily life cannot be considered in psychology, and that the more skillful we become in doing any kind of intellectual work, the farther it is removed from a psychic process. To these propositions it is difficult to assent.

The inadvisability of making consciousness the general form of psychic life that is differentiated into several kinds of processes has been recognized by many persons. Spencer says: "The error has been in confounding two quite different things, having a sensation and being conscious of having a sensation" (*Psychology*, Vol. II, p. 372). Karl Pearson says: "I can receive a sense impression without recognizing it, for a sense impression does not involve

consciousness" (*Grammar of Science*, p. 43). Binet says: "Consciousness accompanies the physiological processes of reasoning, sensation, recollection, etc. It does not constitute them. It is an epiphenomenon and nothing more" (*Psychology of Reasoning*, p. 91). Haeckel states his opinion that: "The greatest and most fundamental error committed by modern physiology is the baseless dogma that all sensation must be accompanied by consciousness" (*Wonders of Life*, p. 289). And again, "Those familiar facts [speaking, walking, eating] prove of themselves that consciousness is a complicated function of the brain, by no means inseparably connected with sensation and will" (p. 291). So also Saleeby says: "We have lately learned that consciousness and mind are by no means synonymous. Consciousness is to be regarded indeed, as the efflorescence of mind" (*Evolution, The Master Key*, p. 172). As holding the same view of consciousness we may mention Romanes, Fritz Müller, Schultze, Paulsen.

The most vigorous and aggressive movement in psychology today is that which is represented by Freud and his disciples, and the entire Freudian system is based upon a principle which asserts that consciousness is not a necessary element in a mental process. In his *Interpretation of Dreams*, Freud says that "so long as psychology settled this question with the explanation that the psychic is the conscious, and that unconscious psychic occurrences are an obvious contradiction, a psychological estimate of the observations gained by a physician from abnormal states was precluded" (p. 485, Trans. by Brill). And again rather sarcastically he asserts that "The physician can but reject with a shrug of his shoulders the assertion that 'consciousness is an indispensable quality of the psychic.' He may assume, if his respect for the utterings of the philosophers still be strong enough, that he and they do not treat the same subject, and do not pursue the

same science." "For a single intelligent observation of the psychic life of a neurotic, a single analysis of a dream, must force upon him the unalterable conviction that the most complicated and correct mental operations, to which no one will refuse the name psychic occurrences, may take place without exciting the consciousness of the person" (p. 485.)

Even more emphatic is the statement that "we must also steer clear of the distinctions superconscious and sub-conscious, which have found so much favor in the more recent literature on the psychoneuroses, for just such a distinction seems to emphasize the equivalence of the psychic and the conscious" (p. 488.)

It appears that the idea that mental action and consciousness are inseparable grew out of the desire of Descartes to prove that man constituted a different order of beings from animals. As that notion was consistent with the ultra religious spirit of earlier psychologists, holding their peculiar views of the nature of mind, it was easy of adoption by them. Recent physiological psychologists have accepted it without sufficient examination, perhaps in consequence of the difficulty of framing any hypothesis of a physiological nature by which the phenomena of consciousness could be presented in understandable terms.

It is difficult to propose such an hypothesis. Feeling and the consciousness of a feeling are declared by Hamilton, Locke, Ziehen, and many other psychologists to be inseparable. But though the relation is such that the two vary together, it is possible to distinguish them by a process of abstraction, and to picture them in understandable terms. While it is true that feeling and consciousness are inseparable in practice, and vary with each other, it is equally true that feeling and intellect are likewise inseparable. So are feeling and attention, feeling and will, and, in fact, none of the fundamental processes that we discriminate can appear alone. Yet, the one is not the other; nor is the other, the one.

Let us note in the first place, that consciousness is not necessary to a mental act. Consciousness is most intense when the mental processes are most imperfect and hesitant. When we are learning to skate, or play the piano, or whet a razor, we are intensely conscious of all the steps that must be taken in learning. But as we become familiar with the process, and acquire skill in doing it, the intensity of consciousness diminishes until when we have attained the highest degree of skill, consciousness seems almost completely to have disappeared. This is one of the fundamental data that we shall have to consider in expressing the relation between feeling and consciousness, and demonstrating a physiological hypothesis for it.

Another fact that must be considered is that we can never be merely conscious. We must be conscious of something. Consciousness can never exist alone. Consciousness is the accompaniment of an intellectual process, such as a perception, or the discovery of a relation, or a feeling which it must accompany. The consciousness may be intense or feeble, it may vary in its intensity without any corresponding variation in the intensity of the process which it accompanies. We shall expect, then, to find the physiological concomitant of consciousness some element of the nervous current, or of the transmission of a nervous impulse through a nervous arc whose concomitant is an intellectual act.

A third fact that must accord with any theory that we may present, is that in nearly every experience of which we are conscious, there is a shadowy background of other facts, events, processes, less vivid than the one that we may consider in the focus, as representing the mental process for which consciousness is the accompaniment. This shadowy background is not necessarily present, and may be very much narrowed or altogether omitted, but its frequent presence materially assists us in suggesting a probable hypothesis for consciousness. These three facts

will enable us to frame such an hypothesis when we consider them all together.

I propose to use the word psychon to express the sum of all the psychological elements that taken together constitute the concomitant of the nervous current. Thus the intellectual process is one of the elements of the psychon; feeling is another; and consciousness is a third. A description of its physiological concomitant will be the most successful means of discriminating feeling from consciousness, and exhibiting their relations to each other. The determination of the physiological concomitant of consciousness is already made for us, in part at least, by our hypothesis of feeling.

We have described feeling as the concomitant of the resistance that a nervous impulse encounters in passing through a nervous arc. But we have recognized the fact that when a nervous impulse encounters resistance, it has a tendency to spread out into the surrounding cells. We have seen that this spreading out into the surrounding cells of the motor region and the glandular centers is the nervous correlate of the expression of feeling.

But not all the impulse that radiates out of the brain center passes into the motor and glandular centers. Some of it passes into the fringing cells around the brain center that are neither motor nor glandular. When this is the case, that portion that so radiates does not produce motion nor glandular activity. If the radiating portion of the nervous impulse were to traverse these fringing cells as if they were other brain centers, each brain center so traversed by the radiating impulse would give rise to an intellectual process, fainter than the original, as the radiating impulse is weaker than the main impulse. It is in some such supposition as this that we can picture the dim, faint, fringe of perceptions and other mental processes that accompany the conscious act. This would be the physiological interpretation of the things that are in the fringe of consciousness.

But this background of faint perceptions and indefinite mental processes is not necessary to a conscious act. We may be conscious of the mental process in the focus, without any of the fringing percepts. The nervous impulse may, and sometimes does, radiate out into the fringing cells without passing through them as a brain center, and completing their circuit. We may say that it radiates into the fringing cells without radiating through them. This will stand to us for the concomitant of consciousness. The radiation of the nervous impulse out of the brain center into the fringing cells that are neither motor nor glandular, then, we may consider as an hypothesis for the nervous concomitant of consciousness. This will give us an interpretation of the process enabling us easily to understand and to express the relation that it holds to feeling.

It is evident that the nervous impulse will not radiate out into the fringing cells unless some resistance is encountered in the brain center. The resistance itself is the concomitant of feeling, but the radiation which follows upon the resistance is the concomitant of consciousness.

It follows, then, that if our interpretation of the physiological concomitant is correct, consciousness and feeling will vary together. Other things being the same, the greater the feeling, the more intense will be the consciousness. The less the feeling, the less intensity of consciousness. This result arises, not in consequence of any causal connection with each other, but because the two—consciousness and feeling—are both similarly related to the same circumstance, the resistance encountered. Whatever increases the resistance will at the same time increase both feeling and the intensity of consciousness. Whatever decreases the resistance, will by that very fact decrease both feeling and the intensity of consciousness. Feeling is not the cause of consciousness, nor is consciousness the cause of feeling, but both of them are related in the same way to the antecedent condition of resistance.

This is a more satisfactory interpretation of the concomitant of radiation than is that of Bain and Richet, who interpret radiation as the concomitant of feeling. Bain says (*Mind and Body*, p. 52): "When an impression is accompanied by feeling, the aroused currents diffuse themselves [radiate] freely over the brain, leading to a general agitation of the moving organs, as well as affecting the viscera." So Richet, (quoted by Höffding, *Psychology*, p. 223) says: "Pain without memory and without radiation would be no pain at all." This seems to justify our assertion that Bain, Richet, and other psychologists recognize the fact of radiation out of the brain center, and would identify it with feeling. But it will be seen that to identify it with consciousness explains phenomena that the other identification will not do.

One other remark ought to be made concerning the association of consciousness with radiation. We have explained the expression of feeling by the radiation of the nervous impulse out of the primary brain center into the motor and glandular centers, as a consequence of the resistance encountered. In the radiation out into the fringing cells that are neither motor nor glandular, we believe that we have the concomitant of consciousness. It appears, then, that consciousness and the expression of feeling arise from the same cause, and are consequences of the same condition. The difference between the two is merely the radiation of the impulse into different kinds of cells and centers. Therefore, consciousness and expression of feeling may in a certain sense be considered homologues of each other, and both of them vary with each other and with feeling. If we choose to stretch a point, we may assert that consciousness is as truly an expression of feeling as is muscular movement itself. This is one way in which, if we choose to do so, we can read a meaning into the phrase, a favorite one with some writers, that all consciousness is motor.

This interpretation of consciousness will enable us to understand two other phenomena which have before seemed incapable of explanation. The first is that consciousness is always involved in the process of learning a new thing, and the second is that consciousness is commonly believed to be the process by which the human race adapts itself to new situations.

The process of learning demands that the nervous impulse should find a passage through new and unaccustomed channels. If the path of a nervous impulse were immutably fixed, and there was no possibility of its flowing over into untraversed combinations of cells, no new process could ever occur and learning a new thing would be impossible. The condition which renders radiation and its concomitant consciousness possible is sometimes described as plasticity. It is upon this plastic quality that the learning process depends.

The fact that a human being consciously adapts himself to new situations has been so difficult of explanation that it is not strange that consciousness has been described as a distinct entity, capable of making adjustments, and unexplainable on any physiological or mechanistic hypothesis.

Adjustment to new conditions implies rapid changes in the nervous arcs through which the impulses flow. When impulses radiate, and consciousness is concomitantly experienced, there is an opportunity for choice between large numbers of possible actions, and the selection of that which is most nearly accordant with the situation. If it were not for this radiation, which we have associated with consciousness, there would not be an opportunity for selecting the most appropriate course of action. Hence we see that radiation, consciousness, functional selection, plasticity, learning of new things and adaptation to new situations are correlative to each other, and depend upon the same neuronic condition. While it is commonly be-

lieved that consciousness makes adjustments, in reality consciousness follows as only one of the results of the plastic condition which enables radiation to occur.

Many elaborate experiments have been made to show that every mental process is accompanied by some muscular movement. It has been conclusively demonstrated that many mental processes are so accompanied, and the general conclusion that all are similarly accompanied is reached deductively.

But another conclusion is deduced from the last, and that is that the muscular movement is a necessary condition of the mental process, or state of consciousness, instead of being an inevitable accompaniment. This conclusion is not justified by the premises, for it can be shown that another explanation is possible.

The only mental processes in which the demonstration of the muscular accompaniment has been attempted are those that are the accompaniments of rather strong nervous impulses. But such impulses, strong enough to be accompanied by consciousness and feeling, are very likely to overflow into the motor centers and give rise to an accompanying movement. So we have movement, feeling, and consciousness attending the intellectual process, but neither of them is a necessary condition. We have in this fact the explanation of the phenomena that is expressed by the phrase: "All consciousness is motor," as well as an explanation of the phenomena from which is derived the statement that every mental process is a state of consciousness.

Consciousness and feeling vary together, and it is a recognition of this fact that has led many psychologists to identify the two, and to assert that feeling and consciousness are identical. It is perhaps a consideration of this fact—for it is a fact—that is at the bottom of the proposition that feeling and the consciousness of the feeling are inseparable, and then follows the assertion that they are

identical. It seems that in our physiological hypothesis we have a means of discriminating the two, and explaining the source of the errors into which psychologists have been led.

We have already observed more than once, that feeling tends to disappear from an habitual act. Consciousness also tends to disappear from an habitual act. Habit decreases directly the resistance that a nervous impulse encounters in a nervous arc, and by that decrease tends to diminish at the same time, consciousness and feeling. The things that we do as the result of habit, or a great deal of practice, come to be done so skillfully that we say we do not need to think about them, and we do them unconsciously. In fact, when a thing is done with the highest degree of skill, we find that an effort of attention which renders them conscious, diminishes the skill and accuracy with which they are performed. The writer has often attempted to discover if he could become conscious of the pressure and movement of the thumb that turns a razor over when it is stropped, but not a single indication of any feeling or consciousness of the movement of the muscles is observable. Practice every day for years in stropping the razor has resulted in the complete disappearance of consciousness from the muscular contraction involved in the process. Nevertheless, this is a truly voluntary act which, as the result of habit has lost all resistance in the brain center, has dropped out consciousness, and all feeling has disappeared. At first, in the process of learning, the consciousness was intense and the feeling was painful.

This phenomenon of the loss of consciousness from a muscular movement as the result of practice is frequently explained by saying that the act ceases to be a voluntary act, becomes a secondary reflex, the nervous concomitant is relegated to the lower nerve centers; and that the nervous impulse which accompanies such an act does not pass through any cerebral center. There is no direct

evidence that the nervous impulse accompanying such an action does not pass through the same cerebral center that it did in the process of learning, and the hypothesis does not explain the facts very well.

Not only is consciousness not essential to a mental process, but it is really detrimental to an action. The highest degree of skill has not yet been attained when we have to think how the action should be performed. Consciousness bears about the same relation to the other elements of the psychon that the noise which a wagon makes in moving bears to the effective movement of the wagon. The old conundrum: "What is it that is no part of a wagon and yet that the wagon cannot go without" is directly illustrative of the point here. The wagon that makes the greatest noise is not the one that is the most effective wagon for the purposes for which a wagon is employed, nor is it in the most satisfactory condition for use. The wagon that makes the least noise, other things being the same, is in better condition for work. There is less energy lost in overcoming the resistance. It is true that we may tell something about the rate of speed of the wagon by listening to the noise that it makes in moving. We may even order the driver to make his wagon rattle more than it does, compliance with which direction may necessitate a more rapid movement of the wagon, but the noise is not the cause of the more rapid movement, nor is it anything to be proud of if one is the owner. Our actions, mental and muscular, performed without consciousness and without feeling are better done, with the same amount of nervous energy, than if feeling and consciousness accompanied them. Less resistance is to be overcome, and more energy is available for doing the work. Hence it is that without consciousness and without feeling, the same amount of nervous energy will do more work.

Consciousness varies in intensity as truly as does feeling. Sometimes we are intensely conscious, and again we

are relatively unconscious. There are all variations of the intensity of consciousness to be observed. Sometimes we are half asleep and again we are half awake, and the difference between the two states reduces itself to zero. Consciousness and unconsciousness are relative terms. We call sleep a condition of unconsciousness, but experiment shows that there are wide variations in the depth or intensity of sleep. The line between sleeping and waking is not a sharp and definite one, and yet, typical conditions of the two states are easily discriminated.

Sleep is a condition in which consciousness is relatively feeble and of low intensity. The unconsciousness of sleep results from the lack of resistance arising from the liberation of a smaller quantity of energy. Always in sleep less energy is generated. The brain is usually more or less anemic, a smaller quantity of blood is sent to the brain, the heart beats slower, less blood is sent out at each pulsation, the skin receives more blood, secretion from the skin is increased. Also, less oxygen is carried to the brain, the breathing is slower, the respirations are less voluminous. Impure air makes us sleepy. So does a hot bath, determining the blood to the skin and away from the brain. Food taken into the stomach induces sleep by determining the blood to the stomach. We avoid the stimulation of the sense organs, shut our eyes, sleep in the dark, get away from the noise, desire to be neither too hot nor too cold, and obviate the irregularities in our couch. By the concurrence of a dozen circumstances we can be assured that in sleep less nervous energy is generated.

As a result of the diminished amount of nervous energy, both feeling and consciousness are lessened. We forget our troubles in sleep, even physical pain does not annoy us if we can go to sleep and consciousness is so much diminished that we apply the term unconscious to our condition. We cannot go to sleep when we are experiencing an emotion of great intensity. And, although from a

dream we sometimes wake in terror, we do awake, when we experience as much feeling as is indicated, and the feeling is not nearly so strong as it appears to be. That this is true can be shown by the readiness with which it is forgotten, and the fact that our terror is not nearly so great as it would have been in the circumstances pictured in our dream, if we had been awake.

We sometimes have what we call a vivid dream. In general, the dreams that we experience which are best remembered and the most vivid are those which occur when we are nearest to the waking point, when the largest amount of energy consistent with our sleeping condition is generated. Then we remember them best because they have happened most recently just before waking up, and hence are most easily recalled. But if a dream is not recalled, reinstated, and rehearsed, scarcely any dream is so vivid as to be remembered twenty-four hours. The vividness of a dream is purely relative, or merely an illusion.

That this is true can be observed by recalling the brightness of a landscape that is seen. The phenomena of a vivid dream were noted, which included the sun shining upon a snow-covered landscape. Comparison of the brightness of the landscape seen in the dream, immediately after waking, indicated that the brightness seen in the dream was about equivalent to that of a moonlit snow-covered landscape seen in a waking condition. It is probable that this is a fair estimate of the relative intensity of the mental processes, especially feeling and consciousness, in sleep.

That this is a true interpretation of consciousness is shown also by the action of narcotics, such as opium, not chloroform, in inducing sleep. Opium and morphine have the property of diminishing the amount of nervous tissue oxidized and the nervous energy generated. Hence the condition of sleep is induced as the nervous energy is diminished. Even before sleep occurs, there is a decrease

in the feeling that is experienced, hence it is that we have the evidence of the concomitant of feeling in the concurrence of diminution of feeling and the coming on of sleep as the result of a dose of opium. Alcohol has something of the same effect. The man who goes out to "drown his sorrows in drink," does so by diminishing the amount of nervous energy that he is capable of generating. We can scarcely wish for a better corroboration of the concomitance of feeling, consciousness, and resistance than the example of the effect of narcotics.

The mental processes occurring in sleep are identical with those in a waking condition, after we have made allowance for their diminished intensity and have realized that attention is wanting. The lack of attention from all dream processes is sufficient to account for the fantastic nature of dreams.

Some such hypothesis as is here proposed will obviate the necessity of introducing into psychology such a conception as a subconscious, unconscious, subliminal or subjective self to explain important phenomena, which the definition of every mental process as a state of consciousness has rendered necessary. As soon as we have limited psychology to conscious experience we are compelled to invent some kind of an explanation for the unconscious processes upon which the conscious life is conditioned. We immediately involve ourselves in a maze of mythological assumptions which are incapable of demonstration or disproof, which become more complex with each demand, and which open the gates to all kinds of charlatanry.

Since feeling and consciousness vary together, it is not strange that one may be mistaken for the other, or that they have been considered as identical. But it is possible to separate the two processes by abstraction and to picture them as the concomitants of different elements of a current. But we may have occasion to inquire whether or not it is possible to experience one without the other. Is it

possible to be conscious and still experience no feeling? Or is it possible to experience feeling without being conscious? The relations are so delicate and so difficult to understand and to interpret that we shall have difficulty in making the phenomena that are significant appear to be so. However, the phenomena come within the experience of every one.

Does a person who is unconscious experience any feeling? It is scarcely adequate to limit the feeling to one having a painful tone. As we have seen, a painful tone of feeling implies a resistance that is very great. But there must be a certain amount of resistance in order that there shall be any degree of feeling, whether it be one having a pleasurable tone or a painful or monotonous tone. Pain and pleasure are merely qualities of feeling, and there may be a feeling experienced, even when there is neither a painful nor a pleasurable tone belonging to it.

Next, if the nervous impulse can be kept from radiating out of the brain center, we may still have the resistance in the brain center itself, and this is the concomitant of feeling. In order to experience feeling without consciousness we need to prevent radiation without destroying the resistance. This is a condition that may be brought about in two ways: first, by the action of drugs, such as chloroform, and second, by a process of attention.

The action of chloroform can best be understood by making an assumption, which all observations bearing upon the point will corroborate, that the effect of chloroform is to cause a contraction and shrinking of the dendrites, as it causes the withdrawal of the pseudopodia when a rhizopod is treated with it. This would prevent the radiation of the impulse out of the brain center. At the same time it probably causes the withdrawal of the terminal arborizations of the cells that constitute the center from each other, so that the resistance is increased. But the radiating effect is diminished more than the resisting effect is in-

creased, and the net result is a loss of radiation and consciousness without a complete destruction of resistance in the brain center.

This phenomenon is complicated by a change in generating power, which, however, seems to be not so great as in case of morphine. Here we are in position to understand what seems at least a very probable hypothesis, that under the influence of chloroform a very considerable feeling is experienced, of which we are unconscious. Certainly the phenomena of chloroform narcosis are very different from those of morphine sleep. There is at first a wild disturbance of the sensory images, a dancing of colors before the eyes, unlike that which occurs in going to sleep. The movements of a person under the influence of chloroform, although probably much less than they would be without the checking effect on radiation, are evidence corroborating the hypothesis. It seems pretty definitely established that feeling of which we are unconscious may be experienced under the influence of chloroform.

Attention diminishes, or may diminish both feeling and consciousness. The mechanism must be explained in a later chapter, but when attention is positive, either feeling or consciousness may disappear. A person who has an arm shot off may in the rapt attention which we call the excitement of the moment, fail to know that he has been wounded. But the resistance has been or may be experienced, and the feeling may, not necessarily must, be very great while the consciousness is lacking.

It is the same question of experiencing a sensation without being conscious of the sensation. The difference, however, is that consciousness does not vary directly with the intensity of the sensation, but inversely with it. While in feeling, varying directly as the two do, and arising out of the same condition, the separation is difficult to see.

There can be no doubt that we do experience sensations without any consciousness of them. We step over an

obstruction in the path, and are unable after we have stepped over it, to remember that there was any obstruction there. The fact that we stepped over it implies, positively, that we perceived it. The fact that we are unable to state as soon as the action is completed that there was an obstruction implies that there was no consciousness of the experience.

In case of feeling, the separation is less easy to see. It appears, however, that we have abundant grounds for believing that we may experience a feeling without any consciousness of that feeling. In fact, nearly all feelings that are monotonous rather than indifferent, neither painful nor pleasurable, accompanying resistances that are below the limit even of a pleasurable tone, are usually unconscious. It appears that in order to experience even the least degree of consciousness, there must be a slightly higher degree of resistance. This is largely theory, the proof of which will from the very nature of the case be difficult to get, but all observations bearing upon the matter would seem to imply that this hypothesis is probable.

All feeling in sleep may be said to occur without consciousness, but consciousness is so completely a relative term that we are scarcely justified in using the term unconscious to describe all sleeping conditions. If we permit ourselves to do so, we shall say that all feelings experienced in sleep are unconscious.

When we reverse the question, is it possible to experience consciousness without any feeling, it is probable that we cannot. The feeling may not be attended by a painful tone, nor by a pleasurable tone, but pain and pleasure are not necessarily inherent in the definition of feeling. But if there is a sufficient amount of resistance to be the concomitant of consciousness, the probability is that the resistance is sufficiently great to accompany some feeling.

SYNOPSIS.

1—*The word consciousness is used in two senses: first, the awareness of our own mental states and actions; second, as a synonym for mind, to mean any form of mental process. It is the first meaning that is adopted in this book.*

2—*Consciousness is not a necessary concomitant of every mental process, and many mental processes are unattended by it.*

3—*Consciousness is the psychological concomitant of the radiation of a nervous impulse out of the brain center into the fringing cells that are neither motor nor glandular. The radiation depends upon the resistance encountered.*

4—*Feeling and consciousness vary with each other, although the relation is not a causal one. Both are similarly related to the resistance encountered in the brain center.*

5—*Consciousness is correlative to motor expression, and might even be regarded as itself an expression of feeling.*

6—*It is possible to experience feeling without consciousness, but we are scarcely likely to be conscious without experiencing feeling.*

CHAPTER XI.

THE RELATION OF FEELING TO MEMORY.

It is a matter of common observation that we remember best those things that we have learned with much feeling. If we are interested in any subject of study, we learn it better and remember it longer. Interest, as the word is generally employed, is understood to mean a pleasurable feeling, but a thing that is learned with a painful feeling is even more readily remembered and recalled more vividly. The story is told that in Ancient Greece, when it was desired to establish and record the boundary between the territory of two cities, a good, lusty boy was taken to the place whose location it was desired to mark, and there he was given a terrible beating. This rendered him a living record of the location, for it was believed that he would not readily forget the place of his agony.

So numerous and so easily observed are the illustrations of the greater readiness of remembering the things that we learn with feeling, that we must recognize the close relation between the two processes. And there have not been wanting psychologists who assert that feeling is necessary to memory, even if not identical with it. It shall be our purpose to set forth as clearly as possible, what appears to be the actual relation between the two.

It may be said in the first place that nothing is remembered that is not learned with some degree of feeling. We may explain this by tracing out the process by which a thing that is remembered is learned. In order to remember anything it must be reproduced and recognized as having been experienced before. There are, therefore, two elements in memory—mental reproduction and mental

recognition. The mental process must be reinstated with the same conscious elements. If the mental process is to be reinstated, it seems quite evident that the physiological concomitant must also be reproduced. The nervous impulse that was involved in the original experience must be repeated. A nervous impulse must pass through the same combination of cells that was traversed in the original experience. This is the concomitant of mental reproduction.

The nervous impulse in the remembering must pass through the same combination of cells. There can be but little doubt of the accuracy of this statement, although some psychologists have sought to call it into question, assuming that a different combination is traversed by an impulse when we experience an idea of a thing from that which is traversed when we experience a percept of the same thing. The association areas are called in to explain this difference. Such a device would seem to be an unnecessary multiplication of machinery and but little confidence can be placed in the validity of such an assumption.

The statement of Bain is worthy of credence here, that "It must be considered as almost beyond a doubt that the renewed feeling (reinstated process) occupies the same parts and in the same manner as the original feeling, and no other part and in no other manner that can be assigned" (*Mind and Body*, p. 89). Pillsbury says that "The treatment of centrally aroused ideas is rendered easier by the present-day assumption that memory images and the original sensations are of precisely the same character" (*Attention*, p. 95). To insist that when anything is remembered, the nervous impulse must pass through some other combination of cells, is to repeat the error of the phrenologists that there is a memory center; or to do what is worse, to assume that there is some kind of a room in the brain where the ideas are laid away in cold storage. Still worse is it to make the assertion, that some psychologists have

not hesitated to make, that ideas are packed away in cells.

One element, then, in memory is the mental reproduction, which has for its concomitant the transmission of a nervous impulse through the same combination of cells that it went through before. Physiologically, then, mental reproduction is the concomitant of the reinstatement of a nervous impulse in the same brain center. There is, however a difference between a remembered experience and the original experience. The original experience is stronger and more vivid than is the remembered experience, and this difference is usually associated with the peripherally initiated impulses which nearly always accompany in some manner the original experience. The peripherally initiated impulse is stronger, more intense, and the accompanying psychological experience is more vivid. The remembered experience is usually accompanied only by centrally initiated impulses which are comparatively feeble. Hence arises the difference in vividness between the remembered experience and the original one. Faint and vivid are two terms used by Spencer to discriminate the original from the remembered experience.

This distinction furnishes an explanation for two series of phenomena that properly belong to this discussion. The first is, that the remembered experience is accompanied by very much less feeling than is the original vivid one. So pronounced is this difference that psychologists generally assert that it is impossible to remember a feeling, in the proper sense of the word. "When we remember that there is almost no such thing as a memory for feelings themselves, but only for the conceptions that accompany them, or are reinforced by them, we can see how the reminiscences of adults upon this point must be received with caution. (Hall, *Adolescence*, Vol. II, p. 38.)

It is possible to remember that a feeling has been experienced when the original of the remembered process was in progress, but it is impossible to reinstate the feeling. While

this is not strictly true, as everyone knows that it is possible to reproduce the feeling by a process of remembering in a slight degree, it is true that the feeling attached to the reinstated experience is much feebler than that belonging to the original. In a good many cases, the original experience was accompanied by a feeling having a painful tone, but the reproduction of the experience is altogether pleasant. This is merely a result of the same difference in resistance accompanying the original and the remembered experience, between the faint and the vivid. But the feeling even of the remembered experience, may be so vivid as to be painful, although the painful character will ultimately disappear as the result of habit. Everyone recalls with pleasure some of the incidents of his childhood, which, when they occurred, were anything but pleasant. Here we have the psychological explanation of the old saying that distance lends enchantment to the view.

It is often very pleasant to contemplate past experience, and this would not be true if it were impossible to reinstate a feeling. The pleasure becomes less as the recollections are indulged in frequently, and never is it as vivid as the original. The taste of a dish of ice cream affords more pleasure than does the recollection of a dish that once was eaten. It is much less unpleasant to remember the dose of quinine that was taken, once upon a time, than it is to take another. Faint and vivid, peripherally initiated and centrally initiated, strong and weak, little resistance and much resistance, pleasurable and less pleasurable, is a series of circumstances functionally related to each other in the domain of the feelings.

If the original experience be one that is accompanied by centrally initiated impulses only, as when we are reading books of travel, stories of incident and occurrences, or historical narrations and expositions, there is not likely to be the same difference in vividness between the feelings accompanying the remembered and the original experience.

There is a difference, but the difference is not so great. Our most intense feelings, whether they be pleasurable or painful, are those accompanying mental processes that are attended by peripherally initiated impulses.

This leads us to a discussion of the second series of phenomena; that the processes that are best remembered are those in which a personal experience with the things themselves is involved. If the original experience involves many sensations, and is accompanied by many peripherally initiated impulses, the object or perception is likely to be best remembered. An examination of the structure of a grasshopper, or a machine, or piece of apparatus is much more likely to fix in mind the structure of the object examined than is merely a description of the thing. Every teacher knows that a part of the value in laboratory work comes from the fact that the things seen are better remembered than the things read about. The impulses are stronger, the percepts clearer, the feelings more intense, and the experience is more easily reproduced.

Many writers upon psychology speak of retentiveness as a property of memory. A man is said to have a retentive memory if he remembers well. The mind is said to retain its impressions, and this figure is similar to that one which speaks of the ideas or impressions being stored up in the brain. It may be well for us to examine this matter of retention, for it involves an hypothesis of the nature of the memory process that is far removed from anything that can be properly conceived.

There is no doubt that every mental experience modifies every subsequent experience. The subsequent experience is something different from what it would be if the antecedent experience had not occurred. But this does not mean that a portion of the original experience is left in the mind. Every nervous impulse that traverses the brain center produces a modification of the center and of the cells that compose it. But this modification is not properly de-

scribed by saying that the cells retain a portion of the former experience.

A pavement may be worn out by the feet that walk over it. Every time that I walk upon a sidewalk I produce some slight modification of the material of which the walk is composed, and remove a few particles of the matter of which it is made. But the sidewalk does not retain me nor any part of me. I have produced a modification in the walk, but that is not a part, or a trace of me that is retained and stored up. The walk has been modified, and may have become slightly better or worse to walk upon, but the few particles that have been removed cannot be called a trace that is retained. In the same manner, the modification of the brain center that has been produced by the transmission of an impulse through it cannot be called a trace of the experience.

This is the answer to the old conundrum, that is still troubling a few psychologists: "Where is the idea when it is no longer in the mind?" "Where is the light when the candle is blown out?" The question involves a wholly pernicious notion of the idea, and a clear understanding of what its nature really is will assist much in solving many problems in psychology. No such clear conception of the nature of the idea can be obtained in any other way than by thinking of it in terms of a nervous impulse passing through a brain center.

We may discard the term retention as an improper and misleading expression of the change that occurs in the brain center, which favors the memory process. We are brought face to face again with the problem that has confronted us so many times: "What is the law of habit, or what is its neural basis?" We are compelled to think of it as some modification of mental experience which has for its concomitant some change in the nervous arc through which an impulse is regularly transmitted. We shall seek an explanation of psychological habit in its neural concomitant.

We have already suggested the possibility that the nervous impulse consists of the transfer of atoms, molecules, corpuscles, or ions from one cell to another of the nervous arc. Let us think of it as consisting of the transfer of the atoms in the molecules of one cell to the molecules of another cell so changing the nature of the molecules that make them up. When an atom, or a large number of atoms, is jarred loose from its combination in the molecules of one cell, it flies to the molecule of an adjacent cell. There is a replacement of one quantity of atoms by another, and a necessity for the rearrangement of the atomic structure.

We may conceive the atoms attaching themselves to one side of the molecule, while the atoms that are jarred loose by the impact escape from the opposite side. The atoms that constitute the nervous wave, or stream, will be prevented from flying off from the path of the conductor by the insulating material, although many may be lost in striking against the insulating walls. Thus the atoms that constitute the nervous stream will pass to the molecules in the path of the conductor. It is not necessary to suppose that every atom that is jarred loose, at least in the early currents in any conductor, reaches the next molecule or the molecules of the next cell.

But if there is a regular stream of atoms, entering a molecule on one side, and corresponding atoms leaving it on the other, the molecules will ultimately become polarized. One pole will be the place of entrance and the other will be the place of exit of the atoms. This polarization will in all probability take the form of growth, so that we may think of the experienced molecules having a different shape, possibly elongated, which the inexperienced molecules do not have. This hypothesis concerning the change in the shape of molecules will explain the processes of growth in cells, and the elongation of the dendrites and axons. It is corroborated by the very limited evidence that an axon or a cell transmits impulses in one direction only.

At any rate, it is easy for us to suppose that as a result of repeated impulses through a cell, and its constituent molecules, the cells and molecules change their shape, and this change renders them a more efficient conductor of the impulse. The molecules escape from their combinations more readily, they attach themselves to the next with greater facility, a larger number of atoms are transferred, and a smaller number are lost in transmission by impact against the walls of the insulator, or other source of failure to find their places in the molecules. Change in shape and elongation of the cell or molecules enables us to understand the phenomena of improved conduction, and may be considered as a theory of the neurological basis of habit.

Memory, then, resolves itself into the concomitant of the neurological basis of habit. But the process which is so clearly manifested by the delicate psychic tests of the sensitiveness of nerve tissue is displayed in other tissues, except that the other tissues are not so sensitive, and do not respond so readily to the changes of growth. The tissues of plants change their shape by growth, which is modified by surrounding circumstances. Light, heat, moisture, gravitation, all have an effect in modifying the growth of plants and shaping their organs and tissues. Every experience of a plant with light, heat, and moisture modifies its growth, and the subsequent activities of the plant are determined in part by these modifications. Hence in a certain sense of the word we may say that a plant manifests the phenomena of memory, but this is an unfortunate expression, since confusion inevitably arises in consequence of using the same term to express two different things. Memory must be limited to a psychic experience, and must not include a physiological process.

Let us now return to the original question from which we have diverged. Why do we remember best those things whose learning has been attended with feeling? Feeling is the concomitant of resistance. Great resistance may be

occasioned by great strength of impulse. The greater the nervous impulse, the larger the number of atoms that shift from one molecule to another, and the greater the amount of change in the shape of the cell and the molecules. Let us suppose that in one impulse, an average of ten atoms are exchanged between any two cells. One degree of resistance will be encountered, and a corresponding amount of feeling will be experienced, a similar amount of change in shape will be manifested, and a proportionate amount of growth will occur. Let us suppose that in another impulse, the number of atoms exchanged between any two molecules is 100. A greater degree of resistance will be encountered, let us suppose ten times the amount, ten times the amount of feeling will occur, the shape of the molecules will be changed ten times as much, ten times the amount of growth will be exhibited, the facility of transmission will be increased ten times as much by the larger impulse as by the smaller. Consequently the next impulse will pass through the same arc ten times as easily after the larger nervous impulse as after the smaller. Amount of current, number of atoms changed, degree of resistance, quantity of feeling, change in shape, rate of growth, facility of transmission, readiness of remembering—all of these seem to be functions, in the mathematical sense, of each other. Hence it is that what is learned with feeling is likely to be best remembered.

Here we have the general law for remembering, and an explanation of all rules and processes that are recommended for becoming skillful in the process. Also we have an explanation why it is that it seems impossible for us to remember at certain times. Anything that prevents our generating and driving through the nervous arc as large an impulse as usual, detracts from our ability to remember. We remember poorly when we are fatigued. The fatigue prevents the liberation of as much energy as is necessary, and it increases resistance to such an extent

that less energy is driven through. We may experience much feeling in learning, even painful feeling, when we are fatigued, but the thing that is learned is not well remembered. So when we are in poor health and feeling bad, we are in condition to liberate little energy, and we do not remember well. We do not remember well what we learn when we are sleepy, since sleepiness is a condition in which little energy is generated. We remember best what we learn when giving the greatest amount of attention to the subject, for attention is the process by which the largest possible amount of energy is directed into and through a brain center. Hence, with the same amount of energy generated, we may by a process of attention learn a thing so that it will be remembered well. Usually, a thing that is learned to the accompaniment of peripherally initiated impulses is best remembered, since peripherally initiated impulses generally consist of a greater amount of nervous energy than do centrally initiated ones. A great nervous impulse will modify the nervous arc and enable us to remember better than a small one. Repetition assists in remembering, because several impulses have a greater effect in modifying the nervous arc than does a single one.

So while it is a general rule that we remember best what is learned with the most feeling, the rule applies strictly only to those cases in which the greater resistance, which is the concomitant of the great feeling, arises from the transmission of a strong nervous current through a nervous arc. If the feeling comes from a diseased condition of the arc, or from the nature of the arc itself, instead of from the strength of the current, the feeling is no satisfactory indication of better remembering. Too much feeling, a painful tone, may be of such a nature as to interfere with the growth of the cells of the arc, and instead of enabling us to remember better, it may diminish our power to remember. Children who learn something as a task that is

exceedingly disagreeable to them do not remember it better in consequence of the greater feeling with which it is learned. Intensity of feeling is not always and under all circumstances, evidence of facility or certainty of remembering.

So far, our discussion of feeling in its relation to memory has been limited to the factor of mental reproduction alone. Retentiveness we have excluded from the discussion as not a factor at all. But mental reproduction is not in itself memory. Mental reproduction may exist without any mental recognition, and the result cannot be called memory. Much more frequently than we are aware, we reproduce ideas that we have obtained from other persons, and we believe them to be our own and original with us. Probably most of our brilliant ideas are of this kind. It seems as if in the organization of our knowledge, it is necessary that the element of mental recognition shall drop out, and the reproduced ideas be brought into juxtaposition as if they had really originated with our own thinking processes. Certain it is that the element of reproduction may occur without the element of mental recognition, and it is possible that mental recognition may occur without mental reproduction.

Before we can say that a thing is remembered, it must be recognized as the subject of a former experience. Mental reproduction and mental recognition are both necessary to memory. Consciousness of the experience as having been in the mind before constitutes the element of mental recognition. What is its physiological concomitant? The proper logical answer to this question will enable us to perceive the true relation between recognition and feeling. Memory is the reproduction of a past experience with all its conscious elements. In order to remember a thing, we must be conscious of the thing when it is experienced. But we have interpreted consciousness as the concomitant of the radiation of the nervous impulse

out of the brain center into the fringing cells, and the concomitant of mental recognition, then, will be the radiation of the nervous impulse out of the center into the same fringing cells into which it spread on the primary occasion. This will comply with our definition of memory as the reinstatement of an experience with the same conscious elements and we may recognize the physiological concomitant in the transmission of a nervous impulse through the same brain center that it went through before, and the spreading out into the same fringing cells.

When we are trying to remember a man's name, we have a feeling of familiarity. We know what it is that we are searching our memory for; we are acquainted with many of the attending circumstances that were in the fringe of consciousness when we learned the name, but we fail to recall it. We drive the nervous impulse through the centers corresponding to each of these attending circumstances, trying to make it slip over into the center which, when traversed, will accompany the name, but we fail to make it go through the name center. Finally we come to some circumstance, from which it seems that the passage over into the name center is easier than it was from the others, and the impulse passes over and we remember the name. The name is reproduced. It seems as if in this experience of the fringing circumstances and the feeling of familiarity, we have the element of mental recognition without that of mental reproduction. Everything is ready to recognize the name as soon as it is reproduced. This fact of mental recognition without reproduction is mentioned by several writers. Colvin and Bagley speak clearly about it. "While as a rule, recall is accompanied by recognition, recognition often takes place without recall." (*Human Behavior*, p. 246.)

If this hypothesis is a valid one, the role of feeling in memory is at once apparent, and the question why we remember best the things that we learn with feeling is easily

answered. In order that there shall be a radiation of the impulse out of the center into the fringing cells, there must be resistance encountered, and feeling will inevitably accompany it. Anything that was learned without consciousness would not be recognized even if it were reproduced. Consequently, feeling, the concomitant of resistance, is almost inevitable in the learning of anything that is remembered. But the feeling is not the cause of the remembering, but is rather an inevitable accompaniment. There is no causal relation between memory and feeling.

The above consideration will enable us to account for the fact that mental recognition is likely to disappear much sooner than the element of mental reproduction. As an experience is reinstated a good many times, the passage through the brain center becomes easier, there is less resistance, the reproduction is more effective and accomplished with greater ease, but in consequence of the diminished resistance, the nervous impulse is not compelled to radiate out into the fringing cells. Hence the element of recognition is likely to disappear sooner than is the element of reproduction, and even to disappear as the element of reproduction increases in certainty and force.

Just as in the case of mental reproduction, however, this feeling is the accompaniment of mental recognition only when it comes as the result of a large and strong nervous current. If the resistance occurs in consequence of the natural inertness of the brain tissue, or some pathological condition of the centers, the resistance and the concomitant feeling will have no effect in increasing the probability of the element of mental recognition arising.

SYNOPSIS.

1—*Memory is the reinstatement of a previous mental experience with the same conscious elements. Its physiological concomitant is the reinstatement of a nervous im-*

pulse in the same brain center that it passed through before, and its radiation into the same fringing cells.

2—The remembered experience is less vivid than the original, and is accompanied by less feeling.

3—We remember best the things we learn with feeling if the concomitant resistance arises as the result of a large amount of nervous energy transmitted. If the concomitant resistance arises from fatigue, disease, or some other property of the nervous arc itself, we do not remember better the things that we learn with feeling.

4—The memory process resolves itself into the concomitant of neural habit.

5—It is scarcely proper to speak of memory in connection with plants, or with animals that do not manifest the phenomena of mental activity.

CHAPTER XII.

THE RELATION OF FEELING TO ATTENTION.

In entering upon the study of attention in any of its relations, we are undertaking one of the most difficult problems in the whole range of the science of psychology. It involves some of the most refractory materials in the psychological complex. Fortunately, it appears that there is a possibility of applying the methods of experiment to its investigation, so that ultimately it may appear not so obscure as it seems to be at present.

A probable hypothesis for directing observation and experiment is very much needed in the study of attention, perhaps even more than in any other phase of the subject. It appears that much energy is being devoted to lines of observation that can prove profitable only by demonstrating what it is not. Fortunately also for our study, the probable hypothesis of attention is necessarily involved in that of feeling.

A nervous impulse is caused to follow its path in traversing the brain center, and in passing from one center to another, by the degree of resistance which exists in the possible paths that it may take. The current follows the path of least resistance, and when this is considerable, it appears to be divided. While the main portion passes directly through the nervous arc, another radiates into other cells than those immediately involved. We may be perfectly assured that the nervous impulse, in a general way, follows the path of least resistance. Any process by which the resistance may be varied between brain centers will direct the impulse, and we are unable to suppose any other process by which it can be directed. In this con-

sideration, we have the key to an explanation of attention.

Attention is a mental process, but we shall best understand it by means of its physiological concomitant, if we can determine what that concomitant is. We may be quite safe in asserting that attention is the concomitant of a process by which a nervous impulse is directed into and through a brain center. But this is a double process, manifesting two phases, both of which are involved in every act of attention.

In order to direct an impulse into a brain center, the resistance must be decreased between the center where the impulse is and the center into which it is to go. But at the same time the resistance must be increased between the center in which the impulse is and the center into which it is not to go. The process by which the resistance is decreased is the concomitant of positive attention, and that by which the resistance is increased is the concomitant of negative attention. In every act of attention, then, we have these two processes of increasing the resistance in one place and decreasing it in another. Attention is a double process, and its physiological concomitant must manifest the same duplex character.

If our explanation of the general character of attention is at all plausible, it is at once seen that there is no possibility of localizing the process of attention, in any portion of the brain. There is no such thing as an attention center, as there is a sight center and a hearing center, for attention is a process whose function is manifested in any center and between any two. Some experimental evidence has been adduced which is interpreted to indicate that the process of attention is located in the frontal lobes. The nature of this evidence is to show that when the frontal lobes are removed or injured, there is a failure of attention. We may admit the fact without admitting the correctness of the interpretation. The strong probability is that the excision of any considerable portion of the cortex

in which nervous energy is generated would result in the failure of attention in an equal degree. The indications of a weakening of attention will manifest themselves whenever and wherever there is a lack of nervous energy. We may pass by the theory of the location of attention in the frontal lobes, as not only unwarranted by the evidence, but as highly improbable from the nature of the case, and contradicted by other well observed phenomena.

There are several suppositions that may be made concerning the nature of the process by which the resistance may be varied. We have already seen reason to believe that the resistance is encountered at the synapses, or points of junction of the neurons, where an impulse leaves one neuron and enters another. We have spoken of the neuroglia as being an insulating substance, meaning that it offers more resistance to the passage of a nervous impulse than does the cell substance. Although difficult of demonstration, this is in all probability true. The problem, then, of decreasing resistance depends upon varying the conducting capacity of that small portion of the neuroglia which separates the arboral terminations of the neurons from each other.

At least two methods are conceivable. We may suppose that the neuroglia changes its conductivity at the point of nearest approach of the neurons, something as the insulating material of an electric conductor may have its conductivity increased by becoming wet. This is the hypothesis advanced by Sherrington, who conceives of the neuroglia surrounding the neuron extensions as a synaptic membrane whose osmotic conductivity is variable, and functional in only one direction. No supposition is advanced about the mechanism by which the osmotic conductivity can be varied, and the hypothesis seems less probable than the next to be considered.

Instead of this we may suppose that the tips of the axonic and dendritic terminations of two cells may ap-

proximate each other more closely so as to bring them into physiological communication, though not likely into physical contact. This would be the condition of positive attention, while a wider separation of the tips of the dendrites would be the condition of negative attention. The shifting of the dendrites, then, either toward each other to accompany positive, or away from each other to accompany negative, would be the physiological concomitant of attention. This second hypothesis is more easily understood, and will be adopted provisionally in these explanations. Whether this shifting of the dendrites is the actual process by which the resistance is increased or decreased, or not, cannot be positively affirmed, but the psychological facts that are observed would all be explained by the operation of this process.

There is some evidence, based upon the observations of Rabl-Ruckard, M. Duval and others, that the dendrites do shift their position. The principal value of their observations for us, however, is to demonstrate that there is such a possibility. The amount of movement observed by them would necessarily be altogether inadequate to account for such phenomena as we find manifested in attention. The phenomena of attention demand a quick movement through molecular distances, or distances so small as scarcely to come within the limits of microscopical observation. And the observation would have to be made upon some animal in which the attentive processes were as rapid as those of man, and probably in very few animals that could be observed do such processes occur. Hence it is very doubtful if the phenomena of movement that this theory of attention demands could ever be observed. It is like the dance of the atoms that no one has seen, but the phenomena that we can observe demand such a movement for their explanation.

The movement of the dendrites has been appealed to by several writers to explain various things, so that the idea

is not a new one. Morat says (*Physiology of the Nervous System*, p. 23): "If the neurons are fixed, they are necessarily immobile. If they are free from attachment, they are capable of receding and approaching each other under conditions that are not yet ascertained. Rabl-Ruckard, Lepine, Tanzi, M. Duval, have appealed to displacements of this kind to explain the dissociations, variations, functional paralyses which are observed in health and in certain maladies."

Wundt (*Physiological Psychology*, Vol. I, p. 46) asserts that: "They [the fibers] never mediate a connection directly between cell and cell. Whenever such a connection occurs, it appears to be mediated solely by the contact into which the dendrites and collaterals are brought with one another throughout the gray substance. This view finds support in the observations made upon the peripheral terminations of the nerve fibers." Also, (p. 51): "The anatomical plan of neuron connections is evidently more adequate than this older view to the physiological results which prove that there exists along with certain localizations of function, a very considerable capacity for adaptation to changed conditions." Again, (p. 54): "Amoeboid movements of the dendrites were first described by Rabl-Ruckard." So we shall find that quite a number of psychologists have observed dendritic movements of various kinds, and the conclusions that we may draw from their observations is that the tips of the dendrites are not fixed. The determination of the dendritic movement as the concomitant of attention is altogether hypothetical, and is perhaps beyond the limits of observation.

We may call this theory of attention, the brain-cell movement, or the dendritic movement theory of attention. It will account nicely for the process of varying the resistance between centers and for directing the current. All the phenomena of attention will find an easy explanation upon this theory. But the difficult matter is to account

for the movement of the dendrites. Why should they move? Here we touch upon the fundamental problem in psychology and, like the question "Why anything is", we shall have to set it aside without discussion until happily we may be able to answer other ultimate questions. The phenomena of dendritic movement appears to be of the same order as that of the movement of any other organic unit. Why does an amoeba move as it does? Why does a sensitive plant droop its leaves? Why does a nervous impulse invariably accompany a mental process? These are questions of the same order, and at present a discussion of them will be found unprofitable.

In cases of voluntary attention, there is always experienced a consciousness of effort. Investigations of the phenomena of attention have been directed largely upon it, and the conclusion has often been reached that the feeling of effort is associated with muscular tension. So much impressed have some investigators been with these muscular phenomena, influenced also probably by James's theory of feeling, that they have not hesitated to declare that the muscular tension accompanying the feeling of effort is attention; that attention consists of the muscular movement and nothing else.

Instead of agreeing that muscular tension is the origin of the feeling of effort, others have believed it possible to demonstrate that it was the feeling of muscular innervation instead. The evidence in support of this view is found in the fact that when a muscle is paralyzed, the feeling of effort is as strong as it ever was. It seems that the muscular contraction is not at all necessary to the feeling of effort. This is a fact that can be testified to by very many persons. Hence it is argued that it must be the innervation rather than the muscular contraction that is the origin. Although the facts cannot be denied, and the advocates of the muscular contraction theory of effort in attention cannot explain them, nevertheless the theory

that it is the muscular innervation instead of muscular contraction is not very generally accepted.

It is without any doubt, in cases of partial paralysis, the nerve fiber that is deprived of function and not the muscle. Hence the muscle is not innervated, and the nervous impulse reaches only into the fiber so far as its function is not destroyed. There is no reason to suppose that in such cases the nervous impulse passes out of the brain center, and we may with as much reason locate the origin of the feelings of effort in the brain center as in the nerve itself. It seems in the light of the evidence, that the real feeling of effort is not in the contracting muscle, but is a central, nervous function.

Ribot localizes the feeling of effort in the head, and believes that it is caused by the contraction of the muscles on the outside of the skull. It will probably be found that the feeling of effort is localized in the head, but instead of being on the outside of the skull, it is on the inside. We may be pretty certain that it is associated in some manner with the movement of the dendrites, not with the contraction of the muscles of the face nor of the body.

We may agree that muscular contraction many times, if not every time, accompanies the process of effortful, voluntary attention, and yet not be willing to admit that the muscular contraction is attention. It seems rather easy to demonstrate that instead of being attention, the muscular contraction accompanying it is, in so far as it exists, a failure of attention.

If there is a decided feeling of effort, we shall nearly always find a vigorous muscular contraction. But if there is a feeling of effort in attention, it will easily be understood that much resistance is encountered in the brain center through which the nervous impulse is passing. Effortful attention is a painful and fatiguing process, since great resistance is encountered. But when resistance is encountered in the brain center, the nervous impulse tends

to spread out into other centers, and to go over into those that are most easy of access, which as we have previously found are likely to be the motor centers, and muscular contraction results. If attention were to be perfect, directing the nervous impulse into and through the brain centers, decreasing the resistance in the center itself, and increasing the resistance between the one center and the surrounding cells, the nervous impulse would not escape from the brain center, there would be no overflow, hence muscular movement would not occur. The muscular movement that is observed in attention, then, results from a failure of attention to confine the impulse to the brain center, and permitting it to escape.

Also, if the attention is not successful in confining the impulse to the brain center by diminishing resistance in it, we shall have much resistance, and the muscular contraction that follows will be accompanied by vivid consciousness. Consciousness, muscular contraction, much feeling accompany effortful attention that is not thoroughly successful. Consciousness, muscular contraction, much feeling are not marks of successful attention, but rather indications of the failure of attention to accomplish its most perfect work.

If the attention is successful in directing the nervous impulse through the brain center, without letting any large proportion of it escape, we shall be able to accomplish very much more intellectual work with the expenditure of the same amount of energy than if the attention is not so successful. We may be very sure that if much feeling is manifested in doing intellectual work, much muscular contraction that has been called the expression of feeling, and a vivid consciousness of what we are doing, the attention is not succeeding so well as it might in doing the work it is capable of accomplishing.

Did you ever see a large boy learning to write? He grips his pen hard, bends his head down to his work, twists

his feet around each other, moves his head in unison with the movement of his pen, his whole body sways, his tongue is thrust out and follows the stroke of his pen. He must, according to the muscular movement theory, be giving great and successful attention to his work. But his writing does not show that attention has been successful. When he has learned to direct his energy more skillfully, he is able to sit up straight, to move his pen without moving his head or swaying his body, and his pen is not gripped so hard. Attention is more successful, the extraneous movements disappear, and the writing is better done. Feeling is diminished, writing becomes a less painful process, he can write without being so intensely conscious of what he is trying to do, and more work is accomplished with the expenditure of the same energy.

The closeness of the relation between feeling and attention is involved in the muscular movement theory of attention. We have already considered muscular movement as an expression of feeling, and the advocates of the muscular movement theory assume that the movements we have described as the expression of feeling constitute attention. Attention, then, is nothing more than the expression of feeling. It seems that this is a legitimate deduction from the premises adopted by the advocates of the muscular contraction theory.

But attention and feeling are closely related, although we cannot admit that they are identical, nor that attention is nothing more than the expression of feeling. We have described attention as the psychological concomitant of the process by which the resistance in the brain center and from one center to another is varied. It is evident, then, that attention is a process by which feeling may be varied, and this is one of the most striking phenomena of attention.

The fact that attention is a double process involving both positive and negative attention, makes it a difficult

process to study. We have no means of discriminating positive from negative except by results, and we can image the two processes only by means of their physiological concomitant. When we speak of attention, it is seldom that the speaker distinguishes which kind, positive or negative, is meant. Hence it is that the most contradictory conclusions are drawn concerning the function and the effect of attention. Any satisfactory theory of attention must harmonize the apparently contradictory experiences, and any theory that does so has in this fact much evidence in its favor.

It will conduce to clearness if we limit our definitions somewhat more than we have previously done, and assume that attention is the concomitant of the process by which the resistance is varied in a brain center and the impulse conducted through it. We may omit for the time the consideration of the physiological concomitant in directing the impulse from one brain center to another. Positive attention is the concomitant of the process by which the resistance to transmission in the brain center is diminished, and negative attention is the concomitant of the process by which the resistance in the brain center is increased. In positive attention the dendrites are shifted closer together, and in negative attention they are shifted farther apart.

It will be seen that negative attention increases feeling. That many of our ills, discomforts, and diseases are imaginary, or manifestations of hysteresis is well known, and known best by those who have studied the matter the most. We can conjure up a pain or an ache in almost any part of the body at any time. A steady examination of the end of the finger for a minute or two will engender a decidedly peculiar feeling in that part, and if it is continued long enough, doubtless pathological symptoms will appear. If we look at a single letter or figure on the page of a book for a few minutes, with the proper kind of attention, we

shall come to the feeling that this is the most peculiar letter or figure that was ever printed. So not only in our physical sensations, but in our social relations and mental operations negative attention is the occasion for most of our discomforts. Jealousy, suspicion, envy, malice, nearly all of the malevolent feelings are accompanied by a process of negative attention. The general name for this whole class of symptoms that verge on the pathological is worry. Worry may be defined as the feeling accompanying the process of continued negative attention.

Perhaps one-half of all the discomforts that we endure arise from this condition. We give negative attention, increase resistance in the brain center through which the nervous impulse is passing, use up energy in overcoming resistance, and while we experience a painful feeling, we diminish the amount of intellectual work that we are capable of doing.

On the other hand, positive attention decreases the resistance in the brain center and is capable of decreasing feeling. If the source of our discomfort is a previous condition of negative attention or if in common phrase our disease is imaginary, or caused by worry, this is all that is needed to cure the disease. Since perhaps half of all of our discomforts are of this kind, the various faith cures and Christian Science and miracle shrines do work that goes far to redeem them from the charge of charlatanry. Every real faith cure, or mind cure, or Christian Science healing, finds its ready explanation in the phenomena of attention. It is a simple explanation, and is scarcely sufficient to justify the founding of a new religion, nor to render less worthy of condemnation the various mummeries and mysteries that are adjudged to be necessary in the operations of saints relics and healing shrines. The various paraphernalia and mysteries and ceremonies and incantations connected with the *modus operandi* of all forms of healing of this kind are merely

devices by means of which the proper kind of attention may be induced. Not one of them can have any effect except as it induces the proper kind of attention, and one is just as effective as the other when, by its means, the proper kind of attention is secured. What is commonly designated as faith healing, prayer cure, magnetic healing, and Christian Science has been described as really effective only when applied to the diseases and discomforts arising from the process of negative attention. Equally successful is the treatment of a regular physician when his medicines produce their greatest effect, as they frequently do, by inducing the proper kind of attention in the patient. In such cases, bread pills are as effective as any other, and frequently to be preferred.

But there are pathological cases involving a lesion of the tissues, toxic products arising from bacterial growth, destruction of functional activities or some other cause, which, no matter how it may be directed, attention will not and cannot heal. Attention will have no effect upon the growth of the germs of diphtheria, nor consumption, and a broken leg will not respond to prayer. And yet, even in these cases, when the lesion is obscure, the painful feeling may be caused to disappear even from the most violent, dangerous and painful of them by a process of attention. Attention of the proper kind may actually decrease the resistance in the brain center until all feeling of discomfort disappears. Then the danger is that the patient reports perfect faith healing and may die the next day. Attention may cause the pain to disappear, but the removal of the pain is not a cure of the disease. Usually, however, the faith healers apply no other criterion to test whether the disease is cured or not, except the elimination of pain.

Pain is, as we have seen, a beneficial device by means of which we are informed of a dangerous pathological condition that may threaten the life and safety of the indi-

vidual. To destroy the pain, either by diminishing the amount of nervous energy by means of opiates, or by faith working through attention, is not to heal the disease, but to remove the test that we might apply to determine its presence, condition or improvement. In such a case, faith cure is on a par with opium. It is like covering the crack in a broken beam with paint.

We have thus made clear the relation between feeling and attention, and we have seen how exceedingly intimate is their connection. We have been able to discriminate the two processes clearly by means of their physiological concomitants whose determination is of necessity altogether hypothetical. However, since the hypothesis has shown itself able to explain all the phenomena of attention, we may assume that it is true until we find facts that contradict it. The utility of the hypothesis does not depend upon the possibility of demonstrating its truth.

The relation between intellect and feeling is a reciprocal one. With a given amount of nervous energy the more feeling the less intellectual work is done, and the less feeling the more intellectual work may be done. But attention is a double process, so we shall expect to find that the law of the relation between attention and the intellectual process will partake of this duplex character.

If we consider positive attention, the relation is easily understood. Positive attention diminishes feeling, and renders the amount of work that can be done greater than if the attention is not so successful. Positive attention may heighten perception or sensation to a very great amount. We can hear a clock tick at a distance many times as great when we are attending as when we are not attending. When we know what to look for, we can see or discover the lost thing with a much greater facility than when we do not know exactly what it is. Hence it is that the problem of apperception resolves itself largely into a problem of attention.

The process by which the perception is heightened by attention seems to be as follows: When I am listening for the clock to tick, I am already imagining how the tick of the clock will sound. I am reproducing the ticking sound that I have heard before, and am already sending a centrally initiated impulse through the clock-ticking center by a process of attention. It requires a much smaller peripherally initiated impulse to pass through the clock-ticking center when the dendrites are all set by the process of attention, thus facilitating the transmission, than if the same setting had not occurred. Hence I can hear the clock ticking much farther away, or a much fainter tick than if I am not attending. The slight peripherally initiated impulse travels the nervous arc, and this constitutes the difference between the percept and the idea.

In the same way we may explain the seeing of what we expect to see. The centrally initiated impulse is already traversing the brain center that corresponds to that object, and a very slight peripherally initiated impulse will pass readily over it. The dendrites are all set so as to facilitate the passage, by the process of attention.

The perception of the slight changes in the tension of the muscles by means of which blindfolded persons find articles hidden by others, the so-called muscle reading, together with other mystifying performances find their explanation in the very much heightened perception resulting from perfect attention. Even the phenomena of hypnosis is best explained by the supposition that it is a process of perfect attention.

This is the explanation given of it by Braid, its founder, and although the explanation has been much criticised, it has not been examined in the light of this dendritic movement theory, and no other explanation has been made that is anything like so satisfactory.

Negative attention has just the opposite effect. We cannot see what we do not expect to see. Every observer picks

out that to which he attends and is unable to perceive the rest. The puzzle in a puzzle picture arises from the fact that we do not know exactly what to look for, are unable to attend to it, do not set the dendrites, so it is difficult to see that which the picture presents. This is the explanation of all that passes under the name of apperception, and it is not a new nor unheard of process.

Consciousness and feeling are directly related. Hence we shall expect to find that the process of attention which increases feeling will increase consciousness, and that which decreases feeling will decrease consciousness. Positive attention tends to decrease consciousness, as will be readily recognized by everyone who has given very close attention to any matter for some time. Under a process of close positive attention, the person finds that time passes rapidly. He becomes so much absorbed in his work that he is almost unconscious of what he is doing. This is one of the ways that we have spoken of in Chapter X by which consciousness becomes diminished. Attention may decrease consciousness by confining the impulse to the nervous arc, permitting little or none of it to escape into the fringing cells. Here we have the explanation of the phenomena often adduced as evidence in favor of the James theory of feeling. A person who is in danger escapes from that danger, and only after the escape does he experience any feeling. At the time of danger, his positive attention processes are very successful in preventing the radiation of the nervous impulse, by diminishing the resistance in the brain center. He escapes from the danger by what seems a miracle. His actions are so perfectly adjusted to the exigencies of the case that they are called instinctive. This is merely perfect attention directing the nervous impulse without waste, accomplishing extraordinary intellectual results, and diminishing feeling and consciousness. Afterward, when the attention is diminished to the ordinary effectiveness, consciousness and feeling appear in

intense form. Even the unconsciousness of the hypnotic state seems to find its interpretation in the lack of radiation occasioned by perfect, or nearly perfect positive attention.

Sometimes, however, unconsciousness is occasioned by intense feeling. A person is said to faint from excess of emotion. Here it seems as if the nervous arc is interrupted in its continuity, and the current is broken. When the current is no longer passing, then none of it can radiate out into the fringing cells, and unconsciousness results. Intense feeling, extraordinary resistance, great negative attention, interruption of all current—all of these seem to be associated with each other. The action of negative attention in producing unconsciousness is similar to that of chloroform, which as we have previously stated, is best accounted for by supposing that the action of chloroform produces a retraction of the dendrites until they are beyond the point of physiological communication, the circuit is broken, the nervous impulse fails to pass, there can be no radiation, and unconsciousness follows.

It seems as if we have in these considerations an explanation of contradictory facts. How the process of positive attention can produce much or little feeling. How both positive and negative attention may bring about a condition of relative unconsciousness. The explanation seems to be satisfactory, and the hypothesis is accordingly helpful.

The relation between feeling and memory we have seen to be generally one of direct relation. That thing is remembered best which is learned with feeling, if the feeling arises as the result of the transmission of the largest possible amount of nervous energy through the brain center, and attention is the process by which it is directed. Hence it is that attention rather than feeling is the determining factor in the process of mental reproduction. If attention were absolutely perfect, it seems as if there might be

a possibility of learning a thing so that it should never be forgotten.

SYNOPSIS.

1—*Attention is the psychological concomitant of the process by which a nervous impulse is directed into and through a brain center. It is the concomitant of the process by which resistance in the brain center is varied.*

2—*Attention has two phases: positive, which is the concomitant of the process by which resistance is decreased; and negative, the concomitant of the process by which resistance is increased. Both phases are involved more or less in every act of attention.*

3—*There are two possible theories: one, that resistance is varied by changing the conductivity of the synaptic membrane; the other, that resistance is varied by shifting the dendrites through molecular distances; toward each other in positive attention, away from each other in negative attention. The second theory is adopted in this book.*

4—*Positive attention may decrease feeling, and this is the explanation of the decrease of pain in faith cures and mind cures. Negative attention increases feeling, and this is the source of pain in worry, hysteria, and imaginary diseases.*

CHAPTER XIII.

THE RELATION OF FEELING TO WILL.

That there is a phenomenon of mental life called will which every one recognizes as a constituent element in his own experience, no one will deny. That its nature is very complex and difficult to conceive in any way, is equally evident. That most of the discussions of will have involved inconceivable propositions, and have been largely beside the question, is quite as demonstrable. The reason for presenting the question in its present connection is found in the fact that there is a recognized relation between feeling and will, and that no discussion of feeling can be altogether satisfactory which does not show the harmony between the theory of feeling and the recognized phenomena of will.

To the older psychologists, will was a simple matter. It was merely a self determination of the substantial entity and was conditioned by no necessary laws. The self activity of the mind and its self determination was will. The "Will determined itself." It was not necessarily determined by anything else. It was a fundamental power of the mind, and no other explanation was necessary or possible.

As psychology, such a conception of will belongs in the section of the psychological museum that corresponds to the cases containing the Great Auk and the Dodo. They are immensely valuable, veritable treasure houses of ideas that once existed, but have failed to survive in the struggle for existence, and have had to resign their places to those conceptions less out of harmony with the facts that have been more recently accumulated.

But even among the older psychologists, there were those who regarded any decision that was made by the will as determined by the feelings. It was a common expression that feelings formed the will. By this was meant that the actions of a person were determined by the will in accordance with the feelings. If one kind of feeling was experienced, the will acted, of its own accord, in one way. But if another kind of feeling was experienced, the will acted in another way, although, had it been so disposed, it might have acted differently. This is merely another statement of the proposition that feelings are the motive powers and lead to action; that feelings determine what the action shall be, whether it is of a mental or a physical character.

In opposition to this at the present time, the opinion is widely prevalent that it is the intellectual idea that determines the action and which works itself out. This is the law of dynamogenesis, and it seems to be supported by satisfactory observations.

Either position may be defended by observations that all will acknowledge to be true, but this merely shows the complexity of the phenomena grouped together as will, and the inadequacy of the theory of will as at present understood. The full complexity of the phenomena not even yet has been fully recognized. All that it is possible for us to do is to point out the complexities, to show how observations apparently contradictory may be harmonized, and to exhibit the phenomena of feeling as manifested in an operation of the will.

Will is a double process, one of whose elements is the process of attention, which has already been discussed; but there is a second element that has not been sufficiently considered. We can best make it clear by a résumé of the propositions that have been advanced in previous chapters.

In every current there are certain elements which are necessary to constitute it a current. The elements

that are common to all currents will very likely indicate the essential components, while those characters which are peculiar to the individual currents will be left out of the number that enter into the conception of a current in general.

In the first place, we have assumed that all the psychological processes that can be discriminated from each other have their concomitants in the elements of a current. It will help us, then, very much to determine what the essential elements of a current are.

Every current must have some kind of a conductor. In the case of a river current, the river bed itself is the conductor; in the electric current, the conductor is usually a wire; in the nervous current, the conductor is a nervous arc which in its simplest form consists of a nerve, two ganglion cells, and another nerve.

Every current must have some kind of an insulator for the conductor, or some method by which the current is kept from leaving it. In the case of a river, the banks serve the function of an insulator; in the electric current, the insulator is a covering over the wire, or it may be that the air itself serves as the insulating material; in the case of the nervous current, we have assumed that the neuroglia, and along the course of the nerve, the medullary sheath serve the function of the insulator. It will be seen, of course, that neither the nervous conductor nor the insulator has any psychological concomitant.

Every current encounters some resistance. In the river current, the resistance is the friction of the water against the banks, the inequalities in the river bed, or obstructions that are encountered. The effect of the resistance is to warm the water in the river. In the electric current, we call the resistance merely resistance, and we measure it in ohms. The effect of the resistance is to produce heat. In a nervous current, the resistance has no other

name. We are unable to measure its amount, but we detect it by means of the chronoscope, and its psychological concomitant is feeling.

Every current produces some effect upon the bodies in the space near it. We may call this space in which it produces such an effect, its field of influence. In the case of the river current, the field of influence is indicated by the water that is drawn by capillarity out of the river into the soil along its banks. Also it is shown by the current of air that is dragged along with the water in contact with its surface. In the electric current, the field of influence is called the magnetic field, and it is mapped with a magnetic needle. In the case of the nervous current, the field of influence is the radiation of the nervous impulse out of the brain center into the fringing cells, and its physiological concomitant is consciousness.

Every current is capable of doing some work. In the river, the work may take the form of driving water wheels, and turning machinery. It is measured in foot pounds or horse power. In the electric current, the work done is the turning of motors and driving machinery. In the nervous current, the physiological work is the transmission of a nervous impulse through a nervous arc, and its psychological concomitant is intellectual work, such as solving problems, memorizing, perceiving, etc.

Every current is directed by changing the degree of resistance to be overcome, making it greater in one path than in another. In the river current it is directed by dams and gates. In the electric current, by switches and shunts. In the nervous current, by the shifting of the dendrites, and its psychological concomitant is attention.

Every current must have some kind of driving force. In the river current, this is provided by the fall of the river or, in case of water wheels, the force of the water is provided by the difference in level between the water

above the dam and the water below, which is called the head. In case of the electric current, the driving force is called the electro-motive force, and is measured in volts. In the nervous current, we have no means of measuring it, and no name for the force. The fact that there is a nervous current is well recognized, but its driving force has not been considered. It is in some way connected with the oxidation of tissue, and after the analogy of the electric current I propose to call this force the nervo-motive force. The psychological concomitant of this nervo-motive force, directed by attention, I propose to describe as will.

It will be seen from this determination, that will is a double process, one of whose elements is the psychological concomitant of the nervo-motive force, and the other is attention, both positive and negative. As we have already discussed attention, it will facilitate matters if we leave it out of consideration for the present, and, using a brief expression, speak of will as the concomitant of nervo-motive force alone.

We have thus described the elements of the nervous current, and have determined the psychological concomitants of each. As we have one word, current, to express the sum of all current elements, so we need one word to express the sum of all the psychological concomitants. The word mind will not be satisfactory, for it has many improper associations. The stream of consciousness is unsatisfactory, for it is based upon a different conception of consciousness. Neither is the general term consciousness available for our purpose. Let us coin a new term to fit the new conception, and call the combination of all the psychological concomitants of the current elements—intellect, feeling, consciousness, attention, will,—the *Psychon*. As this is a new conception in psychology, it is proper to employ a new word to express it. It will be found very helpful to speak of the different elements

of the psychon, instead of the different states of consciousness.

In order to make this determination of will at all probable, we need first to demonstrate that there is a nervo-motive force, and second, we shall need to present evidence in favor of the assumption that this force is the concomitant of will.

The strongest evidence of the existence of the nervo-motive force is the existence of the current itself. By current, we mean the change in successive molecules of the nervous conductor. No one will deny the existence of the current, and no one will believe that the current will flow and successive molecules change without the manifestation of some force. The nature of the force is beyond our comprehension. Whether it is some form of energy similar to one already described in text books on physics, or whether it is a different force from any there recognized, is beyond our province to discuss. Whether it is capable of being transformed into one of the recognized forces and has a quantitative equivalence to them is also beside our present question. But that there is a force, the fact of a current abundantly proves.

Another evidence of the existence of a nervo-motive force is found in the fact that brain tissue is oxidized and the resulting products have a lower degree of complexity than those which they replace. Whenever substances undergo a chemical change resulting in the production of substances of a lower degree of complexity, energy is liberated. The change is a katabolic change, and results in the liberation of energy.

In the next place, we find that all mental processes stop almost instantly when the conditions for this chemical action in the brain are not present. Pressure on the carotid arteries results in unconsciousness in thirty seconds. Hemorrhage induces fainting. The brain weighs only about one-fiftieth as much as the body, but it draws

usually from one-twelfth to one-eighth of all the blood sent out from the heart.

It is not necessary, however, to stop the supply of blood in order to stop mental action. All that is necessary is to shut off the supply of oxygen to the brain, and this may be done by cutting off the supply of oxygen to the blood. The blood may continue to flow, but if the person is in an atmosphere that contains no oxygen the same results follow as if the blood supply were cut off. More than this, we find that when severe mental work is accomplished, there is a greater amount of katabolic substances produced in the brain and excreted from the system.

The next question is, why do we determine this energy liberated in the brain to be the concomitant of will? The reason is not far to seek. The evidence is found in the facts of concomitant variation between the nervo-motive force and the psychological phenomena of will. When we are able to make proper allowance for all modifications of the nervous current that arise from the variations in resistance, character, and modifications of brain tissue, and of the substance of the nervous arc, for the effect of habit, and the variations in attention, we shall always find that the strength of will varies directly as the amount of nervous energy liberated. The facts that constitute this evidence may be grouped under three heads.

The first group of facts are those derived from an examination of pathological conditions of will. We find in every case of weakened will that the bodily conditions are such as to diminish the amount of tissue oxidized in the brain. Some of these pathological conditions are cases of habitual users of alcohol, morphine, opium, cocaine. In every case, the formation of a habit of this kind results in weakened will. Why does not the drunkard of morphine-eater or cocaine fiend discontinue the habit? Every one not so afflicted is sure that under similar conditions he could quit, so why does not the drunk-

ard? The drunkard could if he had the present ability to generate energy that the normal person has, but he does not have it and his will is weak, so the breaking of the habit is a chemical impossibility with him. Indulgence in a narcotic habit always results in lessened oxidation of tissue in the brain. The entire range of metabolic processes in the body is circumscribed, and this can usually be recognized in the paler complexion, ascribed to the lessened number of blood corpuscles which are the carriers of oxygen; in the loss of appetite; in the sluggishness of the circulation; in fact, in almost all the processes that we have found to be essential to the liberation of nervous energy.

We have a classical example of this weakening of the will from the use of opium in De Quincey. He tells us that when he was addicted to opium, letters would lie for months on his table unanswered. He knew that they should be answered, knew exactly what to say in answer, but he could not bring himself to do it. His will was weak. Many of us have unanswered letters, or something else that corresponds to it, and the reason is the same. Our wills are temporarily weak, not perhaps from indulgence in opium, but from other causes. In such a case, when we feel disinclined to work and to do what we ought to do, the only proper thing is to do something that will enable us to liberate more nervous energy. We need to take a vigorous walk, to start the blood to moving more rapidly to the brain, to breathe more fresh air so as to oxygenate the blood.

In this way, by liberating more nervous energy, we strengthen the will. The proper treatment of a narcotic habit is indicated by its effect. The treatment is to do anything that will cause more nervous energy to be liberated. Good food, plenty of exercise to quicken the circulation but not enough to induce fatigue, pure air, and it may be necessary, although it may not, to discontinue

the drug immediately. Anything that will cause more energy to be liberated will strengthen the will. Some cases of weakened will do not arise from a narcotic habit. Some diseases have for their principal symptom a weakness of will. Ribot, in his *Diseases of the Will*, gives many examples.

When one is fasting for several days, the most noticeable and persistent psychological symptom is a weakness of will. Nothing that is not done by the force of habit, and this indicates little resistance, can be undertaken. This fact of little resistance which can arise only from the small amount of nervous energy liberated, accounts for the fact also, that not only the painful feeling of hunger almost disappears after the third day, but all other sensations are diminished in intensity. Notes of the psychological condition of a man completely abstaining from food for seven days continually emphasize the fact of weakness of will. No other condition of a pathological nature was present, but weakness of will was a most pronounced psychological manifestation. When food is lacking to repair the waste of tissue, oxidation cannot proceed with its usual rapidity, and less energy is generated.

Fernald presented to the Psychological Association in 1911, what he described as a "Kinetic Will Test." It was a device by which a person was induced to stand as long as he could without letting his heels touch the floor. By the device employed, the limit of mental persistence was reached before the limit of muscular resistance was encountered, and the time that a person could stand in this position was taken as a measure of the strength of will. This method of measuring the will conforms exactly to the hypothesis advanced in this chapter, and the name "kinetic will test" is thoroughly appropriate; although the name of the test, perhaps by the advice of some persons who would not be in accord with the present hypothesis, has been changed to "an achievement capacity

test," which is a sufficiently meaningless and vapid name to satisfy the least radical.

Another line of evidence is derived from an examination of the intensity of sensation in cases of weakened will. We find that whenever there is a clear case of weakened will the senses are not so acute nor the sensations so vivid as when the will is not weakened. In measuring the acuteness of the sense of touch, the dividers must be spread farther apart in order that they shall be perceived as two points than is the case with the same person at a time when his will is strong. The person with a weakened will cannot detect so small differences in light nor color. He cannot detect so faint sounds, nor are any of his senses so acute.

We know that a sensation is accompanied by an impulse peripherally initiated of a considerable strength. Peripherally initiated impulses which accompany sensations are always strong, and it is by means of this fact that we are enabled to distinguish a percept from an idea. So we shall find that if the amount of nervous energy available for psychological processes at any time is less than the usual amount, the impulses originating in the sense organs will be less than they usually are, and that we shall be unable to experience sensations of the ordinary degree of intensity. The argument is this: Intensity of sensation depends upon the quantity of nervous energy which is manifested by the nervous impulse. The weakened will is always accompanied by a diminished intensity of sensation. The conclusion is that the weakened will is the concomitant of the diminished amount of nervous energy, or *nervo-motive force*.

It is now necessary to consider the relation between attention and the will. Many writers on psychology assert that there is no difference between them, and that a thing is willed merely by a process of attention. That attention is an act of the will, and willing to do anything

means attending to that thing. Let us try to make the relation clear.

The nervous energy that has been generated by the oxidation of tissue must be gathered up and driven through a brain center. It is liberated, probably, in all of the developed brain cells. This is the concession made to those writers who insist that the whole brain is involved in all mental processes, and that the doctrine of localization of function is, if not a gross error, at least very misleading. We may allow that every portion of the brain does participate, in general, in every mental process, by furnishing the nervous energy which must be gathered up and driven through a brain center.

It is like the diffused electricity generated on the plates of a battery. The gathering up of the nervous energy and directing it through the brain center is the work of the concomitant of attention, thus making of it one of the two parts of the double process of will. The nervous energy liberated may fail to be gathered up and driven through the brain center when the effect is as bad as if it had not been liberated at all. This sufficiently explains the facts that have led persons to assert that attention is will. Attention alone is not will, but no act of the will can occur without attention. Voluntary attention is one of the phases of will.

This determination of will also involves an explanation of the phenomena that have led many persons to assert that feelings form the will; without feeling there can be no will; and that feelings are the motive powers.

Our previous study has shown us that the resistance which is the concomitant of feeling is determined by two factors, each varying independently, and producing the resistance as the resultant. The first of these factors is the strength of the current, or nervo-motive force; second, the nature of the arc itself, which may be modified by habit, attention and pathological conditions. In the

production of some feelings, one of these factors will be the principal determinant, and in the other classes of feeling, another. Hence we shall discover that the most contradictory phenomena find their proper explanation in the independent variability of these two factors.

If we limit the study of the will to the single element of nervo-motive force, we shall be able to discover the explanation of the phenomena that lead to the belief that feelings form the will. If we suppose the other factor constant, the feelings will vary with the nervo-motive force. The person who manifests a strong will, then, will be the person who experiences much feeling. When the will is weak, little feeling will be manifested. Attention and the nature of the conductor remaining the same, the strength of will may be reckoned in terms of feeling; much feeling, strong will; weak feeling, little will.

As we have previously seen, the person who is capable of generating little nervo-motive force is not likely to experience intense feeling. The intoxicated person does not experience very much feeling, and does not have very much will. He is easily induced to do things at the solicitation of others, and experiences none of the feelings of shame or remorse that he would if he were not intoxicated. The victim of a narcotic habit, while under the influence of the drug, is relieved of all his painful feeling, mental and physical. The vividness of his feelings and his strength of will disappear at the same time. An intoxicated man is not unaware of what he is doing, but his feelings are so weak that he does not care.

The same thing is true of a very sick person. A person who is approaching the point of death, is not suffering very much, either physically or mentally. He has no mental or physical feelings of any great strength and vividness, and does not will to live. The persons who are watching at his bedside are probably enduring more anguish of spirit than is the dying man himself, for he has

passed the point where he is able to will or to experience feeling. The amount of nervous energy that he is capable of generating is not great enough to encounter much resistance in any part of the brain.

Strength of will and vividness of feeling are associated with each other, although not in a causal way. The feelings are not the cause of the will, nor is the will the cause of the feelings; but both feelings and will are the concomitants of the same process, the liberation of a large amount of nervous energy, which encounters resistance in passing through a nervous arc.

The strength of will is generally judged by means of the amount of activity that the person is capable of exhibiting. The person who generates the largest amount of nervo-motive force is the person who, other things being the same, will have the largest amount of energy to expend in activity, and also will be the one to manifest the greatest amount of feeling. Hence we have the condition that corresponds to the direct relation between feeling and will.

But it appears that under certain conditions when we are least capable of manifesting the activity that is indicative of will, we experience the greatest amount of feeling. When we are fatigued or sick, and are incapable of generating energy in so great quantities as usual, we seem to experience more than the ordinary amount of feeling. Circumstances that ordinarily would not occasion anxiety or worry, annoy us greatly. We are unable to endure the same amount of physical pain, and anger is more easily aroused than before. Anger, worry, physical and mental pain often seem to be excessive in a situation when we are incapable of generating energy in quantity, and when we recognize our condition as that of weakened will.

Evidently this situation is directly contrary to the theory that feelings form the will, or that feelings and will vary directly with each other. The explanation of

the discrepancy and the difference between this series of phenomena and the preceding will be found in the effect of attention in the production of feelings. Whatever the basis of the physical nervous concomitant of attention may be, it is evidently something that is fatiguing and demands the expenditure of nervous energy. One of the first indications of the failure of nervous supply is the inability to fix the attention steadily upon the matter in hand. Hence it is that when there is a diminished amount of nervous force, the failure of attention may be sufficient to increase resistance, and feeling will increase. It is corroborative of this that, in such cases, feeling is increased only in the processes that are unusual and out of the ordinary routine. So long as nothing occurs to disturb our equanimity there is no manifestation of increased feeling; but when an unusual, non-habitual situation arises, and an effort of attention is needed to prevent the increase of feeling up to the painful point, then we fail and the feeling is intensified.

It remains for us to consider will in its relation to feeling as determined by the nature of the conducting material, as it is modified by habit or pathological conditions. We can say but little concerning the relation of will to feeling as thus determined, except to recognize that this factor may completely conceal the operation of attention and the strength of the current. We can establish no law except that, with a given amount of nervo-motive force and a constant capacity for attention, the modification of the conductor by habit will tend to diminish resistance and its concomitant feeling. The law that expresses the relation between feeling and will, when stated in terms of the other factor, will need modification when we take this second factor into account.

Pathological conditions usually tend to increase resistance and feeling, with a given amount of nervous energy. But it appears that there are pathological con-

ditions in which reaction time is diminished, and we might draw the conclusion that resistance is diminished in corresponding amount. Such pathological conditions are those usually associated with inflammation of the nervous tissue of the brain or nerves and when such disturbance becomes very great, the corresponding mental condition is acute mania or delirium. It would seem that the resistance itself is not diminished, but rather increased, and the feeling is very great, but the amount of nervous energy generated is in excess and the mechanism of attention is thrown out of order.

The phenomena of feeling in its relation to the intellectual process has already been described. But it remains to consider that relation in the light of our determination of the concomitant of will. The larger the quantity of nervous energy that is transmitted through a nervous arc, the greater will be the amount of intellectual work accomplished. Hence it will be seen that there is a direct relation between will and intellectual work. An action is determined by the clearness with which it is perceived before the action is accomplished. This fact is sometimes well stated by calling the idea of an action the motive. The clearer the idea of the action, the more certain the action is to follow. If a large amount of nervous energy is already traversing a nervous arc, the dendritic movements are already made that direct it through, and the additional nerve force finds its way easily over the same path.

So we find, as a general rule, subject to modification by other circumstances, that the person with great intellectual power is a person of strong will. As the will is weakened, the intellectual ability is diminished. The modifications to which the law is subject are those arising from the fact that the relation between intellect and feeling is a reciprocal one. We have just described feeling and will, in one aspect of the case, directly related,

and feeling and the intellectual process as reciprocally related. Hence we have a modification of the law to include the effect of feeling, in so far as the feeling arises from the increase in the strength of will. This modification is one whose effect is included in the discussion of the apparent direct relation between intellect and feeling on page 49.

SYNOPSIS.

1—The essential elements of a current are the conductor, insulator, work done, resistance, field of influence, methods of directing the current, and driving force.

2—Each of these elements of the nervous current, except the first two, has its psychological concomitant. All the psychological concomitants taken together may be called the psychon.

3—Will is the concomitant of the driving force of a nervous current, plus attention, which directs the force.

4—That there is a driving force, or nervo-motive force, is shown by the fact that there is a current, and that the metabolic processes result in products of a lower degree of complexity.

5—That the will is the concomitant of nervo-motive force is shown by the weakened will in cases of narcotic habit, by pathological cases of weakened will, and by the fact that whenever the will is weaker than usual, the sensations are diminished in intensity.

6—Feeling and will are directly related to each other if the resistance arises from an increased amount of nervous energy; they are reciprocally related if the resistance is due to a modification of the nervous arc itself.

CHAPTER XIV.

THE RELATION OF FEELING TO THE EGO.

Many persons believe that the presence of feeling of any kind is conclusive evidence of an independent, self active entity that thinks, feels, and wills, which is not a part nor a function of the body, and is not dependent upon the body for its existence. Feeling is considered to be more satisfactory evidence than any other mental process, because it is more completely subjective, and testifies to the condition of the self rather than furnishes information of an external object. This is essentially the statement of Mr. H. R. Marshall, who says: "Feeling is subjectivity, and bears a close relation to the empirical ego. It is the empirical ego which has not yet become explicit." While this statement would probably not be satisfactory to many dualists, it does, nevertheless, emphasize the importance of feeling in demonstrating the existence of the ego.

The doctrine of the ego asserts in a general way that there is an entity, or a substantial existence residing in the body and using the body as its instrument. The body is not a part of the ego, but serves merely as a means by which the ego exerts an influence upon material things. All mental processes are activities of the ego, and are determined by it. The growth of the body, the organization of the brain, the development of the human being, are all dependent upon the ego, which exists independently of them, employing the brain and nervous system merely as a means of acting upon the material world. As feeling does not in itself act upon the external world, it is as-

sumed to be the best evidence of the existence of the ego. There is little distinction made between mind, soul, ego, in this system of philosophy. The three terms are practically synonymous.

Since feeling is commonly assumed to be evidence of the existence of this independent, self active entity, it is necessary to examine the matter somewhat carefully, to see what is the real significance of feeling in the discussion. A careful examination will show that instead of being an evidence of the existence of an independent ego, whatever testimony feeling has to offer, is rather opposed to the doctrine.

The independent, self active entity called the ego or mind, is that which is left after all the properties that pertain to the body have been taken away from the complex unity of body and mind. This is the ground on which the distinction is made between mental feeling and physical pain. Physical pain belongs to the body, and is not an essential constituent of the mind. Mental pain belongs to the mind and not to the body. If we subtract all those properties that belong especially to the body, we shall discover the essential nature of the mind.

Let us consider the mind as existing apart from the body, retaining only those characteristics which are necessary to manifest its real nature, and dropping all those feelings that have been experienced in consequence of its physical connection. Physical pain cannot be considered an essential constituent of it. Physical pain has its function in preserving the body, and by it the mind could take cognizance of injurious conditions.

Besides physical pain, there are many egoistic feelings, whose function is to preserve the body from destruction in dangerous situations. Hunger, thirst, nausea may be considered as belonging to the physical sensations, but the feeling of fear is a mental pain, and its only function is the preservation of the individual. In a state where

the body has already been destroyed, the retention of the feeling of fear would be meaningless and absurd. Hence we readily see that fear, and all other self-preserving feelings belong to the physical organism, or to the complex association of mind and body, and not to the conception of the soul or the mind.

Next, there is a large group of community preserving feelings that have been considered especially marks of the soul. We readily think of pity, charity, and sympathy as examples; but equally so are anger, hate, and revenge. The entire group of community preserving feelings has been developed out of the necessity for preserving the community and preventing it from being destroyed. When all necessity for preserving the community has disappeared, the retention of these feelings would be devoid of significance. Hence it is that we cannot think of them as constituting an essential element in the organization of the mind. Certainly revenge, hate, and anger would be willingly discarded, but they are no less feelings of this community preserving group than are the others and if one may be thought of as necessary, all the others must be.

The holiest feeling of the human heart is mother love. But mother love is one of the race perpetuating feelings, developed out of the necessity for preserving the race and perpetuating the species. When the occasion for perpetuating the species is past, and the physical conditions that render it possible are removed, there can by no possibility be a retention of the feelings appropriate to the functions. Hence the entire group of the race perpetuating feelings must be conceived as having no function, except as they belong to the physiological complex of the body as it manifests mental processes. These race perpetuating feelings belong, not to the essential nature of the mind, but to the physical connection of the mind with the body.

We have now had reason to discard from the essential nature of the mind, all the self preserving, community preserving, and race perpetuating feelings, and it would appear that there is very little left that any one would care to retain. All of these discarded feelings have their reason for being, not in the nature of the mind, but the physical processes of the individual complex. They belong to the physical organism as a means for its preservation and perpetuation. They give warning of danger, furnish a means of multiplying its efficiency, and insure its reproduction, multiplication, and improvement. No one of these feelings could by any possibility have any meaning, or justification for its existence, were it not for the physical organism through which they manifest themselves, and which they preserve. Hence it is that the feelings, when properly understood, furnish not an evidence of the existence of an independent, self active entity, but so far as they testify at all, they demonstrate the inadequacy of such a conception. Instead of upholding the hypothesis that they are cited to prove, their testimony is rather against it. The fundamental principle of psychology, as in all other biological subjects, is that every mental process is now or has been in the recent past, of some advantage to the individual, the race, or the species. But every advantage that is furnished by feeling accrues to the physical complex, and not to the mind considered apart from it.

The problem of accounting for the feelings is not so simple a matter as the doctrine of the ego would make it appear. The feelings are assumed to be the most conclusive evidence of an ego, but the ego is considered to be self active, and every mental process a manifestation of its activity. Feeling, then, is an activity of the ego, and is accomplished by some change in itself, not at all determined by external conditions. The ego feels as it decides or wishes to feel. It is virtually independent of nervous

and material conditions. This means that feelings are determined by the will, and those persons are consistent, if nothing more, who assert that the ego is will, instead of feeling. But even if the will determines the feelings, the will itself is self caused activity, not determined by anything else, and moves from one condition to another without any cause, which is an unthinkable proposition.

One other circumstance is believed to demonstrate the existence of the independent, self active entity called the ego, and that is the fact of a continuity of experience throughout all the years of the individual life. This is the phenomenon of personal identity, and is rather an effect of the functions of memory than of feeling.

It is worthy of note that the continuity is not complete nor absolute. It is rather apparent than real, for the individuality of the person does change. Not only are there rapid conversions, but a slow change is constantly in progress. We fail to recognize it as a change, just as we fail to see the hour hand of a clock move, but the change and disruption of unity is constantly going on. But there are periods of rapid change, turning points in one's life, such as the climax of adolescence, which are easily observed, when, as the result of rapid growth the entire nature seems to change and the person to be made over anew. We fail to recognize the ordinary changes in consequence of their slowness, but nevertheless they are real and important. Two stages in the life of the same individual separated by a period of years are more widely different from each other than the stages of two individuals of the same age. A boy of seven and the man of twenty-five into which the boy develops, are more widely different than two boys of seven.

The only thing that consciousness, or cognition, can report is a mental process. These are the ultimate facts, and that there is an ego of which these processes are activities is clearly an inference. That feeling is any

more an evidence of a self active ego than any other mental process cannot be admitted. One mental process is quite as conclusive or inconclusive as another.

There is a very proper use for the term ego and for the term mind. The ideas which these terms connote are important and necessary. The concept of the ego is formed by a process of abstraction and comparison. If we compare all the activities of the human being, the inseparable complex of the physical organism and the mental processes, and abstract from all the activities that it manifests the common elements, we shall have a combination of the characteristics common to all the activities. This is a general abstract notion which we may designate as the ego. The ego, then, may be defined as the sum of the characteristics that are common to all the activities of the human being. By a similar process, abstracting from all the mental processes their common characteristics and combining them into one whole, we shall have the general abstract notion of mind.

That the concept of mind is a general abstract notion is shown in many ways. Neither feeling, consciousness, nor intellection gives us any direct knowledge of mind. The only ego that is perceived in any manner is that which is manifested in the inseparable complex of body and mental processes. No mental process has ever been experienced nor observed separated from body and brain, and we have no justification for assuming that any such separation is possible. No inference can possibly be legitimate which carries thought farther than its connection with a nervous system.

But a general abstract notion has no actual, tangible thing to correspond to it. It is merely a name for the sum of qualities and not for an actual independent existence. Life, nature, mind, spirit, reason, justice, are such ideas. They are important and necessary for thinking, but the mistake occurs when we accept these crea-

tions of the natural consciousness as actual objects. When we give them a tangible existence and apply them as causes to the explanation of phenomena, then we do violence to truth and block the way to progress.

Happily, in other departments of science, we have already passed this critical point, and no longer seek to explain the phenomena by an appeal to the abstract. We are no longer content to explain the rush of air into an exhausted receiver by saying that nature abhors a vacuum. We are not satisfied to account for any natural phenomenon by saying that nature acts in that particular way. Nature as a cause is not sufficient to account for the phenomena that we see. No physicist regards gravitation as anything more than an abstraction, and the law of gravitation as a statement of the uniformity in the activities of bodies. It is not conceived to be an actually existing thing that serves as a cause.

Neither is it a satisfactory explanation of mental phenomena to say that the mind acts in such or such a way, nor that the mind interprets certain appearances. Mind and the ego are as much obstructions in the way of progress as are nature, gravitation, and life, when they are described as real entities and employed as tangible existences to explain natural phenomena. The actual things that do exist are the phenomena observed. So in psychology, the actual things that we are called upon to study explain and account for are the feelings, rememberings, and willings. So psychology becomes the science of mental phenomena, not the science of the mind. It is not necessary to develop a theory of the mind before undertaking the study of the phenomena. The science of physics is not built upon any theory of the constitution of matter nor the nature of force. Such theories are constantly changing without in the least modifying the phenomena observed nor interfering with the value of the laws that have been established.

The concept of mind is derived by a process of abstraction from the phenomena, the phenomena are not deductions from the nature of the mind. Only by means of an approach to the subject in this way is psychological progress possible. To assert that mental phenomena are the manifestations of mind, and that these phenomena exist because the mind acts in such and such a way, is similar to the method of studying geology that accounts for the position of a mountain range by saying that God made it there, and reasoning from the Nature of God that he would naturally locate it where it is.

All recent advances in psychology have been made by a practical discarding of the conception of mind as an entity and no progress is possible so long as it is retained. Progress in psychology has been made by a study of mental phenomena, not by speculations upon the nature of the mind. The method of writing psychology that begins with a definition of mind, its nature, and properties, corresponds closely to the method of writing history which begins with tracing the genealogy of the earliest kings of the country from Adam down.

So numerous and important are these limitations of the doctrine of the ego, that as a scientific doctrine it must be discarded, and no longer be considered in the discussion of psychological subjects, but it remains for us to account in some way for the phenomena that were believed to render it credible. We have already seen that feeling, so far from being any evidence of the truth of the doctrine of the ego, and the independent existence of the mind, is not favorable to the theory it is called upon to support. It remains, however, to point out the significance of feeling, and to interpret it in a way that is consonant with all the phenomena of physical and mental life.

There can be no question that feeling and every other element of the psychon, has been developed by the processes of variation, fixed by natural selection and transmitted by

heredity. Each of these elements of the psychon has contributed some advantage that rendered a person better fitted to survive in the circumstances in which he was placed. There are many devices employed to adapt different organic beings to their environments, and many others that might have been employed instead of those that were.

Feeling seems to be one of those devices by which the human being has been adjusted and enabled to survive in the struggle for existence. The self preserving feelings enabled the individual to escape danger, the community preserving feelings multiplied the strength of the individual by the strength of the entire community, and the race perpetuating feelings guaranteed the continuance of the race and the pressure upon subsistence that enabled natural selection to operate.

The feeling of fear led the human being to escape from his enemies, but fear is only one of the many devices that might have been employed to accomplish the same result. In animals such as the social insects, in whom the social organization is more pronounced, and the length of life is shorter, there seems to be no indication of such a self preserving feeling as fear. In the human being, love of offspring is one of the most influential feelings, while in many animals no such feeling exists, but a different device is employed to continue the species. Such a device is manifested by some fishes, where a single fish may lay ten thousand eggs, and no parental care or parental feeling is manifested.

The entire group of feelings may be considered as a series of devices to accomplish the purpose of adapting the individual and the race to its environment. Why is it that these particular devices were selected out of all the multiplicity of possible devices that might have been employed, and which are shown in the constitution of other organic beings, is one of the ultimate questions. There is no essential reason why feeling should have been the par-

ticular device employed in man to adapt him to his situation, any more than that the number of his arms should be limited to two instead of extended to five, as in the star fish. Neither can we explain why man has become adapted to his environment through the device of moving from place to place, instead of procuring his food while remaining stationary, as plants do.

Consciousness is another device by which man becomes adjusted. It seems rather a clumsy, inefficient device, available for a transition period, but which tends to disappear as the adjustment becomes perfected. However, it enables an adjustment to be made in situations where, without it, the race would be compelled to die out, or abandon certain localities. It stands in the place of reflexes and ready-made instincts. Hence it is that plasticity of organization instead of fixity of structure is associated with the highest forms of consciousness. While it is rather a condition of less efficiency, it is sometimes demanded by the necessity for meeting the conditions of a changed and rapidly changing environment. In no other way and by no other device with which we are acquainted, could the race so quickly adapt itself to changed conditions. This accounts for the fact that many other animals have much more completely fixed instinctive adjustments than man, and the extreme plasticity of organization that is associated with the lack of fixed instincts makes it necessary for man to remain longer in the period of infancy.

Every manifestation of life consists of the operation of some device by which an individual becomes adjusted. Man is the best example of adjustment by means of consciousness, feeling, and intellection. It is doubtful, however, if the human species is at all better adjusted to its environment, or stands a better chance of surviving in the struggle for existence, than do many of the plants. The ragweed is protected from being eaten by a bitter taste, while its branching habit, terminal spikes, lacinate leaves, and fourteen or fifteen other devices, are so correlated with

each other as to render the plant admirably adapted to its environment, and to insure its propagation in large numbers, by which it is more likely to survive. A single plant may produce five thousand seeds, and for every seed it produces about five hundred thousand pollen grains. Yet the plant is without intelligence as we understand the term, and without feeling. Intelligence and feeling are devices by which animals, and especially man, have become adapted to their environment. Plants have become extremely specialized in another direction which does not include intelligence and feeling.

This is the origin and significance of feeling. It ranks in the constitution of the human being, with the terminal spikes and bitter taste of the ragweed. Both have a corresponding origin, and both are explainable on the same principle. We have tried to show how it is associated with the brain and nervous system, and the function it performs.

It is necessary for us also, in discussing the relation of feeling to the ego, to consider the second series of phenomena that are relied upon to demonstrate the existence of a substantial entity of mind, or the ego. That is the phenomena of personal identity, and the persistence of the individual through all the years of his natural life. We have already seen that this continuity is not so nearly absolute as it is commonly assumed to be, and it is our purpose to explain how such continuity occurs, and the limits that are possible to it.

This element of personal identity was formerly supposed to be the result of an intuition, and immediate knowledge different from the ordinary processes of perception and reason. The mind knows itself immediately. It is a function of its self activity. Various explanations are assigned for it, but if we are to place psychology on a natural science basis, it is necessary to show a foundation in physiology for this function of identity or sameness in the different stages of individual life. We must be able

to account for it in some way, to discover its physical and nervous concomitant for the basis of all its mutations, changes, transformations, and developmental stages.

It is not difficult to show that every intellectual process is capable of being reduced to a single form, that of the perception of resemblance. The ordinary sense perception is of this kind, and a simple judgment is nothing more. A syllogism involves the perception of resemblance between two concepts compared indirectly, and every other form of reasoning—whether inductive, deductive, analogy, recognition, naming, or classification—involves the same thing. It is, therefore, the one process that is essential to any act of the intellect.

We have an easy interpretation in physiological terms of the perception of resemblance. It would appear that in every case where a resemblance is perceived, its concomitant is the transmission of an impulse through some cells that are common to the two centers traversed in the perception of the two objects compared. Two ideas that are totally unrelated seem to have for their concomitants the transmission of an impulse through two centers that have no cells in common.

In making a simple judgment, whose expression is a proposition, the idea which is the subject has for its concomitant the transmission of an impulse through one combination of cells. The idea whose expression is the predicate has for its concomitant the transmission of an impulse through another combination of cells, some of which at least, belong to the same combination of cells that was traversed when the idea which is the subject was experienced. The element of resemblance has for its concomitant, then, the transmission of the impulse through the cells that are common to the two combinations, which may be many or few as the resemblance is great or small. When this proposition is carried out to its legitimate conclusion, it will appear that every intellectual process has for its psychological concomitant the transmission of an

impulse through a combination of cells, some of which, at least, have been traversed on one or more previous occasions.

But this will assist us to conceive of the concomitant of the idea of personal identity, or the ego, in terms of the old psychology. Every mental process has something in common with some other, or every other mental process. We recognize a similarity or we should not call them mental, and there are further resemblances.

It is evident that the first impulses that traverse the brain will pass through isolated centers. There must be two or more combinations of cells traversed before an impulse will pass from one to the other, or before ideas are associated. Later, nervous impulses pass from one center to another and association of ideas begins. Ultimately it will come about that when a larger number of cells have been developed, and association fibers are numerous, that it will be impossible for a person to have an experience that does not involve as its concomitant the transmission of an impulse through centers, some cells of which have been traversed before. No unrelated experience is possible. When this condition arises, a personality is born, the feeling of personal identity is aroused, all subsequent experiences have something more or less in common with every other, and there is a continuous connection between earlier experiences and all later ones. This is the explanation of the fact that while two boys of seven are more nearly alike than is a man of twenty-five and the boy of seven from whom he has developed, that there is a kind of resemblance or continuity between the man and the boy that cannot exist between the two boys.

If it were possible to open up a new system of brain centers, and to interrupt the connections that are now formed between the sense organs and the sense centers to bring into operation cells that had never been traversed before, then we should expect the continuity to be interrupted and a new personality to appear. This explanation seems to

be possible, and is able to account for the physiological connection between mental processes, and for the facts that were believed to necessitate the postulation of an entity called mind.

It would seem, then, that the recognition of an ego in the naive sense of the term, is an illusion of the first order. The problem is much more complex than has been assumed. It involves an answer to the question why any nervous impulse is accompanied by a mental process, and this we have found to be unapproachable by any means at our command.

For the science of psychology, it is impossible to admit the introduction of such an hypothetical entity as the ego. We have become able to study physiology without assuming the presence of an hypothetical entity called life of which all vital activities are manifestations, and we are able to describe the phenomena of a living body in terms of chemistry, force, and matter without introducing life as a cause. We cannot be too frequently reminded that such a method of studying physiology was not attained without much struggle and much opprobrium heaped upon the heads of the physiologists. The dissection of the human body was forbidden by law in some countries, and the physiologists who treated the matter from the standpoint of natural science were subject to many material and verbal indignities.

So we have become able to study botany and zoology without introducing into it an external cause of which every structure and function is an expression. Only in some manner as this has it become possible to establish a science of physics, chemistry, geology, botany, zoology, and physiology. No science is possible unless we assume at the beginning of it that nature is uniform in all respects, and all activities that we see manifested are neither capricious nor uncaused, but that each has an antecedent which it is possible for us to discover by an examination of natural laws.

Thus it is that psychology must conform to the uniformity of natural laws if it is ever to become a science. No factor must be introduced into the discussion that would make of mental processes phenomena completely outside of the order of nature and non-conformable with it. Psychology is the science of mental phenomena, not of the activities of an hypothetical entity introduced for the purpose of explaining them. By regarding psychology in this way, progress is possible, while without it there is no hope. Otherwise we shut the door deliberately against all attempts to increase our knowledge, and we waste our energies in useless speculations upon the nature, origin and destiny of this entity of mind.

Only by regarding psychology as a natural science and applying to its elaboration the same principles of scientific study that have been so laboriously worked out in other subjects, can we see a possibility of developing a science of education. If there were to be postulated an independent, self active entity that is determined in all its activities by itself alone, and not by the conditions of its surroundings and its physical connection, all educational laws would be limited to the capricious determination of the self active entity. But if we regard the human being as part of the natural world, subject to the same laws and conditions as are other parts of creation, then we discover the possibility of a science of psychology and of education.

SYNOPSIS.

1—*Feeling is regarded by many persons as the best evidence of a self active entity called ego, or mind. Feeling is considered as the activity of this self active entity and a proof of its existence.*

2—*It can be shown that the evidence of feeling is directly contradictory to this supposition, and feelings find their raison d'être in the physical organism.*

3—*The distinction between physical and mental feeling*

originates in the recognition that some of the feelings exist as a consequence of the necessities of the physical organism. But equally well it may be shown that all feelings originate in the same necessity. All egoistic feelings have their reason for being in the effect they have in preserving the body; the community preserving feelings arise as a consequence of the necessity for preserving the community, and the race perpetuating feelings from the necessity for perpetuating the race. None of these feelings would have any reason for being if the mind were an entity capable of acting in a feeling way, and existing apart from the bodily organism.

4—*Knowledge of the ego is not given directly. It may be understood as arising from the perception of sameness among all mental processes, which has its concomitant in the transmission of an impulse through cells that have been traversed before.*

5—*This same transmission of impulses through cells that have been traversed before, accounts for the continuity of the individual. If it were possible to experience mental processes which were accompanied by impulses traversing cells and centers, none of which had ever been traversed before, the continuity would be interrupted and a new personality would be born.*

6—*Psychology is a natural science, and rests upon the assumption that nature is uniform throughout. The metaphysical conception of a self active, independent ego, of which the feelings are manifestations, must be discarded as has been discarded the conception of nature, or of life, as an explanation for phenomena in biology and physics.*

7—*Consciousness, feeling, and intellect are devices which have been adopted to enable the individual and the species to survive. Other organisms have adopted other devices, but consciousness, feeling and intellect seem to be the most effective in enabling an animal to make quick and prompt adjustment to the exigencies of changed and changing conditions.*

CHAPTER XV.

MENTAL ONTOGENY.

If we can establish the truth of the proposition that feeling is the concomitant of the resistance encountered by a nervous impulse in passing through a nervous arc, and that all other mental processes have their concomitants in some of the elements of the nervous current, we shall have a means of pushing our investigations into the origin of the mental processes of a child much farther than if we had no such hypothesis to guide our researches. It seems highly desirable that we shall make the application of the doctrine herein enunciated to the beginnings of mental processes, since, for the teacher at least, the study of the mental processes of the child is the most important part of psychology.

We shall proceed upon the assumption that the theory of feeling, and the other processes associated with it, has been demonstrated or rendered highly probable by the line of argument and evidence adduced in the preceding pages. If this can be shown to be not true, our speculations concerning the origin of the mental processes will likewise have to be discarded, and the corroborative circumstances will of necessity seek another explanation.

We find in the infant at birth, no mental processes established. It would seem like an error in judgment for Höffding to assert that the "Beginnings of conscious life are to be placed, probably before birth." (*Psychology*, p. 4.) What we do find is that the only processes established at birth are certain reflexes, and these are such as are necessary for the immediate continuation of the independent life of the child. The reflexes that move the

lips and organs of the mouth are present, and these are necessary to enable the child to take his first nourishment. The reflexes that move the respiratory muscles are already well established, for without these movements the child would be unable to survive the first five minutes of an independent existence. The reflexes of grasping with the hands are well established, and we find that the child in the first half hour of his independent life is able to grasp a stick or finger, and by means of this grasping reflex, to support the weight of his body for a period varying from two seconds to a minute and a half. This reflex persists for several days or weeks, but finally diminishes. Its presence points us back to the time when the ancestors of the human race lived in trees. Such a reflex was without any doubt of serious importance to the preservation of the life of the child in the arboreal, primitive condition of man, although it is no longer of essential value. It is a vestigial reflex, and is historical rather than of immediate utility.

The crying reflex is also established, and is immediately available. This reflex is essential to the child, for it is a demand upon the parent for assistance, without which the life of the child is impossible. It is significant that this first signal of the child for assistance is an auditory rather than a visual one. Correlated with this fact is the fact that the ears of the parent manifest no device by which the sound stimulus may be shut out, as the eyelid shuts out the light from the eye. The auditory signal of the child is not affected in its stimulating properties by the change of day and night.

All of these reflexes (not instincts) are present at birth, and are of essential importance for the preservation of the child's life in the first few minutes or few hours of his independent existence. They have been established by variation, fixed by natural selection, and transmitted by heredity. Like all other reflexes, they involve no mental

activity. It is extremely probable that no one of these reflexes is accompanied by the transmission of an impulse through a cortical center, but that only what are called the lower centers participate in their production. It is characteristic of a true reflex to be accompanied by no mental process. It has no motive in the psychological sense of the term, and cannot be considered as an expression of any element of the psychon. If any action does involve a mental process, it cannot be considered a reflex.

We must look for the beginnings of mental life in the activities of the senses. The senses at birth are inactive. The child is born deaf and blind. He cannot taste or smell. It may be questionable if the sense of touch or temperature is capable of functioning. All of these senses must acquire their proper activity after birth. Let us study the development of the sense of hearing, and that may serve as a type for the other senses.

At birth the child is deaf. The ear itself is not ready to function. The external auditory meatus is closed, and its edges are in contact with each other. Before the ear can function, it must open and permit the air to come into contact with the tympanic membrane. The middle ear is filled with liquid which must be carried away before it can become functional. When these changes have been accomplished, the ear is ready to function, but the child cannot yet hear. The vibration of the air strikes the tympanic membrane, but until a nervous impulse is established in the terminal filaments of the auditory nerve, there is no possibility of hearing. We have no means of judging how many repetitions are necessary before the vibrations will establish an impulse.

After a nervous impulse has been established in the terminal filaments of the auditory nerve, it must be transmitted to the hearing center in the brain before there is any possibility of a sensation of hearing. It may be that the first impulse which is established in the terminal fla-

ments is transmitted to the brain center, and goes through a combination of cells, but from what we know of the rate of transmission of a nervous impulse in a nerve, and the improvement by practice through a nervous arc, it would seem reasonable to suppose that the first impulse which is started gets only a little way in the nerve. The second impulse would travel the same path, and would proceed farther along the auditory nerve than did the first one. The third and succeeding ones would travel along the course of the first impulse, each encountering less resistance than the preceding until finally a nervous impulse would succeed in getting into the brain center.

But we know that in the brain center, a much greater degree of resistance is encountered than in the nerve itself. Hence we should expect it to take a much longer time to establish a pathway through the brain center than through the nerve. The first impulse that enters the brain center would, in all probability, be lost completely and not succeed in making a complete circuit. Hence its concomitant would be all feeling, and not an intellectual process, a sensation. This is the interpretation that, in the light of the present day knowledge, we might put upon Mr. Spencer's statement that, all intellectual processes grow out of feeling.

Finally there comes a time when the nervous impulse succeeds in overcoming the resistance and gets through the nervous arc in the hearing center. A hearing center is thus organized and the sensation of hearing is established. This process of organizing the brain center, overcoming the resistance, establishing a nervous impulse, and modifying the nervous tissue until it will permit a nervous impulse to pass through, demands some time. Hearing may be established in the first two days of life, but it is more likely to be three or five days. A child may be deaf for four weeks and still ultimately become able to hear, although, if it cannot hear at the end of the fourth

week of life, the probability is strong that it will never hear.

The process which we have illustrated by means of the sense of hearing, is the same process that is manifested in the original functioning of every other sense. It may be that the sense of touch, the most fundamental of all the senses, is organized at birth, but the reflexes that are adduced as evidence do not prove it to be so. It is probable that the brain center for touch is not more easily permeable for the nervous impulse than is the center for hearing. Whether promptly or slowly, we must recognize that all the senses become functional in the first few days or weeks of life. It remains for us to inquire what mental processes are involved in their activity.

Assuming that the preceding propositions can be established, it will appear that the first mental process that occurs is feeling, coming even before the intellectual process of sensation. The resistance that is to be overcome in a brain center in process of organization is relatively great. It has already been shown that the principal difference between a feeling that has a painful tone and one that has a pleasurable tone is associated with a greater or less degree of resistance. Since the resistance that accompanies the transmission of the first impulses through a nervous arc is a great one, we may say with a good deal of probability that the first feelings are painful in tone. We reach this conclusion in a theoretical way, thus corroborating the observations of many persons who have believed that they recognized in the first cries of a child the expression of pain. Thus Höffding speaks of the "Cry of pain with which the infant begins its life." (*Psychology*, p. 4); and Darwin says that "Infants scream from pain directly after birth." (*Expression of Emotions*, p. 352.)

It is certainly questionable whether this interpretation of an infant's cry is justified, but we do know that the

cry of a child is an expression which later is associated with a feeling having a painful tone, and not with a pleasurable feeling. It much precedes the laugh, which later we learn to interpret as an expression of pleasure. Many observers refuse to recognize in the cry an expression of pain, but certainly it is not an expression of pleasure. In fact, all that we can say, if we refuse to recognize in the cry an expression of pain, is that the cry is a reflex, and not an expression of feeling at all. This is certainly a reasonable interpretation, and the cry is not an evidence that the first feelings are painful. Nevertheless, it is probable that the first feelings are painful, and that the reflex cry comes to be adopted as an expression of a painful feeling because it is already well established when the first painful feelings are experienced.

There is one way of looking at the matter in which we may say that the first mental process is not a painful feeling. If we consider feeling a form of consciousness, and assert that there can be no mental process of which we are not conscious, then the first mental experiences are not painful feelings. The child does not manifest any consciousness at the time that the first nervous impulses are passing through the brain centers. But we have seen that this use of the word leads us into very great difficulties, and it seems much better and more in accordance with the facts, even though in opposition to the prevailing custom, to say that there are many mental processes without the accompanying phenomena of consciousness, or awareness, of the process.

We need to ask whether the child manifests any consciousness in connection with the process which we have described as a painful feeling. We have little to guide us here except our theoretical considerations again. If we think of consciousness as the concomitant of the radiation of the nervous impulse out of the brain center into the fringing cells, which radiation is occasioned by the resist-

ance which the nervous impulse encounters, we have the conditions for consciousness. But at the same time, the resistance that is encountered in an attempt to pass into the fringing cells is also very great, so that it is doubtful if in the first nervous impulses there is any radiation, and consequently if there is any consciousness. The probable conclusion is that the first impulses that enter the brain center are not accompanied by radiation, that feeling is experienced without any consciousness, and that a feeling of a painful tone exists. We may have the same kind of a mental process that is experienced by a person asleep who is afflicted with nightmare. The person may be unconscious, but every one who observes him will feel confident that he is experiencing some kind of a painful feeling. Similarly, when a person is undergoing a surgical operation under the influence of chloroform, the conditions of pain are there—if the narcosis is not too deep—but the consciousness is wanting. It seems more nearly in accordance with the facts for us to think of these experiences as pain, rather than a total absence of all mental processes.

Feeling, then, appears in the psychon before consciousness. When repeated attempts to pass through a brain center and as frequently repeated attempts to radiate out into the fringing cells have so modified the brain centers that the nervous impulse can escape, then we have the physiological conditions of consciousness, and this third element of the psychon has become established. The first consciousness is naturally very vague and indefinite, and this fact of itself modifies the expressions that tell of the presence of other elements, and renders the determination of the first appearance of consciousness in the psychon impossible. At the very best, the first appearance of consciousness must bear about the same relation to a fully developed consciousness that the acorn bears to the tree that springs from it.

From a single sense a child gets a single sensation. This is scarcely complex enough to be called a perception, but the difference is not very great. From every sense he may receive a sensation when all of them become active. There comes a time after many sensations have been received from different senses that the nervous impulse established in one end-organ combines with the impulses established in other sense organs according to the law of the attraction of the impulse. We have, then, two or more impulses which run together, and we have two sensations established at the same time that modify each other. This is the physiological condition of perception.

The running together of two or more impulses established in different places, some of which are peripherally and some of which are centrally initiated, is the physiological concomitant of perception. The two or more sensations are associated by that form of the law of resemblance which is called coexistence. When two or more nervous impulses are established at the same time, as when we see a bell and hear its sound, or see and feel an apple, the combination of these two or more sensations constitute the process of perception. It can be shown that all knowledge is relative, and that nothing is known except as it is related to something else. Perception, as well as every other mental process, depends upon the perception of relations. The formation of the general abstract notion, judgment, reasoning, are different degrees of complexity in the perception of relations. They all have one common element, and when one, such as perception, is established, we have in it the germ of every other intellectual process, no matter how complex the process may ultimately become.

The first experience that leads to perception is not a perception in itself. Perception involves the recognition of relations, and since it is possible to use the term resemblance in a sense broad enough to cover all forms of

relation, we may say that perception involves the recognition of resemblance. This recognition of resemblance implies that a nervous impulse traverses some of the brain cells that have been traversed before. We shall never have a perception unless some of the cells involved have been traversed by an impulse on a previous occasion.

Memory is not a new or really different process. It becomes established in consequence of the modification of the nervous arc by the transmission of a nervous impulse through it. The process of memory described in Chapter XI may be considered as having its concomitant in the transmission of a nervous impulse through the same brain center that it traversed before, and the radiating out into the same fringing cells. However, in order to constitute the process a process of memory, the impulse must be centrally initiated and not peripherally, otherwise it would be a repetition of the original experience, and vivid; instead of a remembered experience, and faint.

As repeated experiences which are accompanied by the transmission of a nervous impulse through a nervous arc become numerous, and the nervous impulse spreads out into the fringing cells, the arc becomes modified in such a manner that it is very easily traversed by even a feeble impulse, such as a centrally initiated one always is. When such a centrally initiated impulse is able to traverse such an arc, and to spread out into the same fringing cells, we have the physiological concomitant of memory in its two phases, mental reproduction and mental recognition. There is no new element introduced. The nervous impulse goes through the brain center, the concomitant of the intellectual process; it encounters resistance, the concomitant of feeling; it radiates out into the fringing cells, the concomitant of consciousness.

It will be seen, then, that there is but little difference in the times at which the three elements of the psychon become established in the germ. Feeling is probably the

first, and is very shortly followed by consciousness and sensation. Out of sensation, by an association of sensations, and running together of nervous impulses, grows perception, and this involves the perception of relation, or resemblance, in which is the germ of every other intellectual process, which develops from it by an increase in complexity. By a manipulation and modification of these three, we come to experience every other possible process and modification of the mental life.

The consciousness of self does not develop so soon as does consciousness. A child is conscious long before he is conscious of himself as exercising the mental processes. The personality is not born for some time after the mental processes of feeling, consciousness, and perception have become established. The explanation of the process of the development of personality is to be inferred from the description of it in chapter XIV. The first recollections of a person are usually of something that has been experienced somewhere between the ages of one and three years, although in extreme cases reports have been made that seem to be well established as any others, of something remembered at the age of ten months.

When such an event occurs that is thus remembered, we may be satisfied that the consciousness of self, or personality has become fully established. The time at which a child discovers that he has hands, or that his hands belong to him, is an important epoch in his life. It is a phenomenon that is seldom overlooked by a mother, or other person who has intimate knowledge of a baby. The probability is that the consciousness of self, or personality, has become established sometime before the first remembered experience, or even before the child has found his hands.

After a child has arrived at a certain stage in his development, which point is reached before he has attained the age of two years, or even a year and a half, his brain

centers have been traversed by so many different impulses, and so many different brain cells have been traversed, that no subsequent experience is likely to involve a wholly new set. The feeling of familiarity or resemblance, is to be found in every subsequent experience however diverse. Every experience has an element of sameness which is associated with the employment of the same brain cells. It is this element of sameness in every experience, which, when abstracted, constitutes the feeling or idea of personal identity.

We may picture the matter to ourselves in this way. We have in our brains perhaps seven hundred million brain cells. It is probable that no large proportion of them is ever traversed by an impulse. Let us suppose that one hundred millions have at some time been traversed. Let us represent this number and group of cells by *A*. Let us represent another hundred millions of cells by *B*, and so on. All of our previous experiences have been confined within the limits of the hundred million cells designated by *A*. Let us suppose that we could have a totally unrelated experience, open up a new set of brain centers which would involve none of the cells in the portions designated by *C*, etc. Then we should undergo a series of experiences in which there would be no feeling of familiarity and a new personality would be born.

Such a conception will enable us to explain the phenomena of double, or alternating personality, although we cannot account for the mechanism by which such a transformation of centers, pathologically developed, might be attained. Such a conception is considerably more satisfactory than it is to describe the alternating personality as a "Portion of the consciousness that has split off." Whenever there comes a time that it is impossible to have an unrelated experience, we may say that a personality has been born. Until an unrelated experience is impossible, personality, or the consciousness of self, is still undeveloped.

The oxidation of nervous tissue liberates nervo-motive force. We must suppose that this liberation of nervo-motive force occurs wherever brain tissue is oxidized. This process of oxidation and liberation of force, no doubt, begins as soon as oxygen is carried directly by the blood to the brain tissue. Hence we have from the very beginning of life, perhaps, antecedent to the independent existence of the child, the physiological process whose concomitant we have recognized as one of the elements of will. It is the nervo-motive force that drives the impulse through the brain center, but it is scarcely capable of originating a centrally initiated impulse sufficiently strong to pass through a brain center until the center has been modified by previous experiences brought about by the stronger peripherally initiated impulses. Hence, although nervo-motive force is available immediately at the beginning of independent life, nevertheless, there is no possibility of an act of the will until after the establishment of the other elements of the psychon.

Nervo-motive force is only one element of the will. Attention, which directs the nervous impulse through the brain center, is another, and we shall find the element of attention appearing along with the other elements of the psychon. Whatever it is that directs the nervous impulse through the brain center and prevents its spreading out into other paths, is the concomitant of rudimentary attention. In all early experiences this directing of the nervous impulse is essentially of the same nature as a reflex. The nervous impulse follows the path of least resistance as that is determined by the structure of the brain, and the nervous pathways already organized. There is no effort involved in the process, and in all respects this early process of directing the nervous impulse corresponds to the description of spontaneous attention. It depends upon the constitution of the brain centers, it is a matter of heredity, and spontaneous attention appears

in a rudimentary form as soon as a nervous impulse is directed into and through a brain center. All forms and degrees of attention are derived from this primary, fundamental condition.

But there is still a difficult process to study, and to show that it harmonizes with the other propositions laid down in this chapter. We have already studied the beginnings of rudimentary will, by means of its physiological concomitant, but we need to study the process by which a conscious voluntary act manifests itself. We shall need to trace the development out of a reflex, through imitation into the conscious voluntary condition.

A reflex is not a mental process. A muscle may contract reflexly by means of a stimulus applied either directly to the muscle itself or, much better, by a stimulus applied to the motor nerve which produces a much more vigorous contraction. It is possible, and even decidedly probable, that the first reflex contractions of the muscles of a child involve none of the cerebral motor centers. But when a muscle contracts reflexly, there is established in the sensory nerves of the contracting muscle an impulse that is carried backward to the brain center for muscular sensation. We do not know the location of the muscular sensation center, as we do that of the sight and hearing centers, but, reasoning by analogy, one exists, and the sensory impulse originating in the muscular contraction is carried to it. The muscular sensation center becomes organized by repeated experiences of this kind.

The next step in the process is one in which the child comes to perceive the movement of his hand, or other organ that is moved by the muscular contraction. The muscular sensation is experienced, the child sees his hand moving, and perhaps experiences the sensation of touch from the movement. The combination of all these sensations and the recognition of their resemblance, coexistence, and contiguity, constitutes the perception of the movement of the hand.

As a result of the organization of the muscular sensation center, a nervous impulse runs through it easily, and flows over into other centers most easy of access. These are likely to be the motor centers, although it is probable that many other centers are innervated to a greater or less degree. The first movements that follow upon the overflow of these impulses from the muscular sensation centers are not likely to be limited to the movement of the hand, if that is the organ that has moved, but many muscles, of the head, legs, body and hand, may all move as a result of this overflow. These movements may be considered as expressions of feeling, although they are not commonly so regarded.

The next step in the process is imitation. Imitation manifests itself in children long after the reflex movements have occurred, and there is abundant time for the organization of the motor centers in the manner just described. Imitation is believed to be manifested by a little child some time between the age of three (Preyer) and nine months. (Baldwin.)

Suppose that a parent waves his hand at a little child. The muscular sensation centers, and the sight center for the waving of the child's hand have already been organized by previous experiences. They have been associated in the process of perceiving the movement of the child's hand. The impulse traverses the sight-hand-waving center, it may pass over into the muscular sensation center for the contraction of the muscles that move the hand, and then it flows over into the motor centers for the waving of the hand, and the hand moves in response. The hand waves in response, because of the similarity between the parent's hand and the child's hand. The similarity exists in the hand, and it has its concomitant in the cells of the sight and the muscular sensation centers. It is in this way that the child perceives that it is the parent's hand that moves and he interprets and knows the mean-

ing of the action by this process which has for its concomitant the transmission of the impulse through the sight center, the muscular sensation center, and the motor center. This is imitation, but it is not a conscious voluntary act.

A sufficient number of such experiences lead to a modification of the different centers involved in the imitative act until finally a weak, centrally initiated impulse may travel the same path. When this is the case and a centrally initiated impulse does traverse the sight center, and passes over into the muscular sensation center, and overflows into the motor center, then the child is able to see and feel his hand waving before it moves. He has an idea of the movement before the movement is made. This is an antecedent mental act, which constitutes the motive to the action itself. It is just this antecedent mental process, which has its concomitant in the nervous impulse passing through the hand waving center, that makes the difference between the reflex, or the imitative act, and the conscious voluntary act. Also, in just this situation, the nervous impulse overflows into the motor center especially if there is a sufficient amount of current to accompany considerable resistance, and the movement follows. This movement is a conscious voluntary act, and comes as the result of previous experiences of a reflex and imitative nature.

This last point, the establishing of a conscious voluntary act, is the point, at which in general, will is believed to originate. As we have already seen, will is established before, when there is a liberation of nervo-motive force and the direction of it by an effort of attention. The will is established before there is any conscious voluntary act.

SYNOPSIS.

1—The theory that feeling is the concomitant of resistance, and that other elements of the psychon are concomi-

tants of corresponding elements of the nervous current, enables us to study the phenomena by which the mental processes of a child begin.

2—The only processes established at birth are reflexes which are necessary to enable a child to survive the first few hours or first few days of an independent existence.

3—We must seek the beginnings of mental life in the activities of the senses. The sensations are not experienced until a sense organ has become functional, a nervous impulse established in the peripheral nerve endings, carried to a brain center, and the nervous arc traversed.

4—Much resistance is encountered in the initial passage through a brain center, and much concomitant feeling experienced. The feeling is probably decidedly painful.

5—Consciousness is not established until after repeated trials a nervous impulse is not only able to enter a brain center, but to radiate out into fringing cells. This is probably accomplished before an impulse succeeds in passing properly through a brain center.

6—When an impulse succeeds in traversing a brain center, sensation is established. When two or more sensations are established at the same time, and their concomitant impulses run together, we have the conditions of perception.

7—By a modification of nervous arcs, weaker centrally initiated impulses are capable of being transmitted through the brain center, and memory is awakened. Attention is involved in any process by which the impulse is directed through a nervous arc. Will exists in germ as soon as nervous energy is liberated.

8—Personality and the consciousness of self is established as soon as there have been a sufficient number of experiences so that it is impossible to have an unrelated one. When it is impossible to pass a nervous impulse through centers, none of whose cells have ever been traversed before, a personality has been born.

CHAPTER XVI.

FEELING AS MOTIVE.

Every conscious voluntary act is preceded by some kind of a mental process which is called the motive. The action follows upon the motive as an effect follows a cause. The motive must always precede, and it is an erroneous conception of a motive to consider an action as induced by the effect which follows upon the action itself. The motive may be such a mental process that it anticipates the result of the action, but in order to constitute a motive, the mental process must be experienced before the action is performed. A reflex differs from a conscious voluntary act in the fact that no mental process accompanies it.

Many psychologists consider that every conscious voluntary act is motivated by feeling, and that feeling constitutes the essential antecedent condition, without which no action follows. They would regard the proposition as self evident that without any feeling there would be no occasion, desire, disposition, or possibility of moving. A common expression is that "Feelings form the will," and no conscious voluntary action can be conceived except as the result of some feeling experienced. Dr. McCosh speaks of feelings as the Motive Powers, and it is believed that feelings have their principal functions as motives to action.

On the other hand, there are psychologists who believe that the idea is the motive and the only essential antecedent mental process. An idea is an intellectual process, and may be discriminated sharply from the affective process of feeling. An idea is the psychological concomitant of the transmission of an impulse through a brain

center and, strictly interpreted, the impulse must be one that is centrally initiated. Those who regard the idea as the motive, point to the fact that every idea tends to work itself out into action. Whenever an idea is entertained, the action which corresponds to it is already begun. If the idea is faint and obscure, the action is feeble and manifested only slightly. If the idea is clear and definite, the complete and vigorous actions follows. The idea of an action is the beginning of the action itself. If there is only feeling without the idea, any action that follows is merely reflex, spasmodic, and uncoordinated. Every idea will manifest itself in some way; if not in positive, vigorous action, then in slight movements that can be detected by an automatograph.

Here, then, we have two contradictory theories apparently irreconcilable. The advocates of feeling as a motive fail to discover any motivating force in the idea, while the advocates of the motivating force of the idea, even if they acknowledge the presence of the feeling, fail to discover that it is necessary to the action, but regard it rather as a hindrance. The more nearly perfect an action becomes, the more nearly free from feeling is the antecedent mental process.

The proposition that feeling is the motivating force was advanced before any special consideration was given to the physiological processes accompanying it, and when we undertake to describe the manner in which feeling brings about a conscious voluntary act, we find it is impossible to do so. No one has ever described in a satisfactory way, the manner in which a mental process of feeling can cause a nervous impulse to run out into a muscle and produce a contraction. Still less is it possible to show how feeling can direct a nervous impulse into a particular muscle, thereby selecting the action to be performed. Hence it is that we find the psychologists who consider feeling to be the motive, minimizing the importance of the physio-

logical processes involved, emphasizing the lack of knowledge concerning them, and relying for explanation upon a metaphysical assumption altogether out of harmony with the fundamental conception of a natural science. In consequence, also, of the felt difficulty of this position and its extreme importance, inadequate theories of feeling are received with a degree of favor far beyond the merits of the theories themselves.

In this respect, the advocates of the idea as the motive maintain a much more satisfactory position. It is a fundamental proposition in psychology that the idea is the concomitant of a nervous impulse passing through a brain center, and that after having passed through one center, it is transmitted to another through which it also passes. If this second center is a motor center, an action follows, and it is well understood that the idea center is closely connected with the corresponding motor center, if not in part identical with it.

But the statement of the motive as made by the new psychologists, is far from being satisfactory in consequence of its lack of appreciation of the function of feeling. Even if it is recognized that feeling is experienced at the same time with the motivating idea, no reason can be assigned for its presence, and no function for it is perceived. It seems very difficult to bring the two processes into one scheme of action and to show the function of each. If the idea alone is the motive, then feeling has no function in determining action, and our fundamental assumption in the preceding pages is inaccurate and the argument is non-sequential.

Here, then, we have the problem clearly set forth before us. Is feeling the motive, the essential antecedent mental condition of an action, or is the motive an intellectual, ideational process, without which no action is possible? If, as seems probable in view of the conflicting evidence, we shall feel it necessary to assert that both feeling

and idea are necessary constituents in the motive, it is incumbent upon us to show what is the function of each, and in what manner each enters into the composition of the motive. The problem is a difficult one, and one concerning which there is the largest amount of data seemingly defying all attempts to reduce it to an orderly arrangement. It appears, however, not to be insoluble, although many things about it will need to be supplied from hypothesis, rather than from direct observation.

The assumption made in the preceding pages is that in some way feelings have been serviceable in the preservation and development of the individual and the race. A feeling is not advantageous in itself, but can have an advantageous function only as it induces, causes, modifies an action or renders it more efficient. The names that we have applied to the different classes of feelings are meaningless and absurd unless it can be shown that they are specifically related to action. The self preserving feelings can assist in the preservation of the individual only by inducing some action that leads the individual out of danger, or by rendering some danger-escaping action more efficient. The community preserving feelings can contribute to the preservation of the community only by means of some action to which they hold some essential relation, and the race perpetuating feelings could have no effect in perpetuating the race, did not some action follow directly upon the feeling itself.

From such considerations it appears that so long as we uphold the doctrine that feelings have been important processes in the development of the race, we must place ourselves with those who consider the feeling as the motive to an action. Such conclusion, however, would be premature.

One consideration has apparently been overlooked by the advocates of feeling as a motive—that is that no feeling is ever experienced except in connection with an

idea. The feeling is an accompaniment of an idea, and can never be experienced without it. I say in general this is true. In Chapter XV we have seen reason to believe that the earliest mental processes are feelings without accompanying ideas. But the resulting actions are not conscious, voluntary actions, but purposeless, unconscious, unwilled movements, motivated by feeling and differing from reflexes only in the fact that the impulses which innervate the contracting muscles are transmitted to the muscles from a brain center instead of from a spinal or non-cerebral ganglion. This action that is completely motivated by feeling cannot be considered a typical action, whose explanation it is necessary for us to seek, nor will it be adduced as an example by any person who considers feeling as the motive. Our admission that there are actions completely motivated by feeling will bring no satisfaction to the advocates of the theory. Such actions are, indeed, unusual and extraordinary, and must be regarded as the limit toward which feeling as the motive tends.

On the other hand we have a series of conscious voluntary actions performed under the influence of a motive in which feeling is reduced to a minimum. We have reiterated the statement in previous pages that feeling tends to disappear from an habitual act. As a result of repetition, an action comes to be performed without any feeling and even without any consciousness, but it is not thereby deprived of its voluntary character. Instead of calling such actions secondary reflex, it is a much more nearly accurate designation of their character to call them unconscious voluntary. All feeling and all consciousness may have disappeared from the antecedent motivating process, and the idea alone constitutes the motive. Here we have the other limit toward which the motive tends, and when an action has approached the motivation of this limit, we may assert heartily to the proposition that the motive is the idea and not the feeling.

Between these two limits is the great body of actions whose necessary mental antecedents include both feeling and idea, together with other elements of the psychon. This is to say that the motive of any typical action includes both feeling and idea, and that any interpretation of the motive that excludes either is at best only partial and incomplete. It now remains to determine what is the function of each in the motive, and so substitute a complete and satisfactory statement of the motive for one that is only partial and incomplete.

Feeling and idea, affection and intellect, are experienced at the same time as the concomitants of different elements of the same nervous impulse. There is no necessary relation between the relative intensities of the two processes, and the psychon may show at any instant a varying intensity between the two, from a limit of pure feeling to the limit of pure idea. We have interpreted the feeling as the concomitant of the resistance encountered in passing through a nervous arc, which resistance is the resultant of two factors producing contradictory effects, and demanding two laws to state them. One of these laws has been stated by saying that with a given amount of nervous energy the feeling varies as the resisting power of the nervous arc. When the resistance is determined largely by this factor, there is a reciprocal relation between intellect and feeling. The greater the feeling, the less exact, effective, and vigorous will be the action. When the nervous arc itself furnishes much resistance, the resulting ideational process is likely to be feeble, obscure, and unlikely to result in certain, definite, well directed voluntary action. Much feeling will be experienced, and little effective action will follow. In our discussion of esthetic feelings we learned that, in general, the esthetic feelings are the accompaniment of resistance arising from bringing new cells into the circuit, and we recognized that a large part of the resistance accompanying esthetic

feelings depends upon the nature of the nervous arc. As a general rule, persons of esthetic temperament are unable to get things done. Few artists are men of affairs, or capable of manifesting the highest executive ability, and persons generally of an emotional temperament are not likely to carry out to completion a long continued and difficult course of action.

So long as there is much feeling arising as the concomitant of resistance depending upon the nervous system itself, the mental processes and the muscular movements are erratic, hesitating, and ineffective. As the muscular movements become positive, efficient, and emphatic, the feeling diminishes. Activity itself seems to have the effect of diminishing feeling; feeling diminished, the action becomes more effective. Any person who is experiencing intense feeling of any kind, finds in action a method of diminishing its intensity. From all these things it appears that so long as feeling constitutes any large part of the antecedent mental process, the action is not highly effective.

The above considerations are relied upon to justify the assertion that it is the idea, and not the feeling, in the antecedent mental process that constitutes the essential factor in leading to action, and is the real motive. Our analysis shows that this position is capable of being maintained only in cases in which the feeling that precedes the action is the concomitant of resistance which has its origin in the nature of the nervous arc itself. If only such actions are to be considered, the argument in favor of the idea as the motive could be maintained with a high degree of plausibility, and would be difficult to overthrow. But there is another series of actions to which such an argument will not apply.

There is another factor which determines the amount of resistance, and that is the strength of the current. The nervous arc remaining the same, the greater the current

strength the greater the resistance will be. The greater the current strength, the larger the amount of nervous energy that will pass through the arc. But the greater resistance is the concomitant of increased feeling, and the larger quantity of transmitted energy is the concomitant of greater intellectual work and clearer ideas. The clearer the idea becomes, the more certain it is to result in action, and the more effective the action will be. Hence it is from this condition alone, the more effective and vigorous action is accompanied by more intense feeling. There is a direct relation, instead of inverse, between intellect and feeling, between feeling, idea, and action.

We have many examples of men of action who are at the same time men of deep feeling. We expect the orator and the preacher to manifest considerable emotion, and his discourse is not likely to be effective unless he does. It appears that in such persons, a lack of emotional display is likely to be considered as indicative of a mind in which the mental processes are feeble and hesitant. Similarly, gesture and movement in a speaker are taken to be indicative of a high nervous tension, much feeling, vigorous ideas. And so we have examples every day of men who feel keenly and act resolutely and effectively. It is upon examples of such actions that those psychologists rely who assert that feeling is the motive, and that the more intense the feeling the more vigorous the action will be.

We thus see that the contradictory theories arise from partial views of the function of feeling. Our hypothesis enables us to see how each party has deceived itself by a partial view, and that neither is wholly right nor wholly wrong. Feeling is the concomitant of resistance which is the resultant of two opposing factors having contradictory effects and varying independently of each other. What the resultant will be in any particular set of circumstances it is impossible to calculate or predict. Be-

sides this, the resultant is modified by a process of attention, or attention constitutes a third factor which still more seriously complicates the problem.

In view of the fact that every action in its origin is motivated by feeling, that feelings have undoubtedly been advantageous in the development of the race, that they can be advantageous only by means of their influence upon actions, we are justified in asserting that feeling is, in general, an essential constituent of the motive. Then again, in view of the fact that, with the exceptions noted, no feeling can be experienced except as the accompaniment of an intellectual process, that there can be no conscious, voluntary action without an antecedent idea, that feeling diminishes and almost disappears as actions become more skillfully performed, we are equally justified in asserting that the idea also enters as an essential constituent into the motive. Neither feeling nor idea alone is the motivating force, but feeling and idea are both essential constituents in the antecedent mental process which results in action.

But the most important question remains to be answered. Having decided by evidence of the highest degree of probability that both feeling and idea belong in the motive, it is incumbent upon us to show the function of each. Unless this is done, we shall have aided little in the solution of the problem. It is certain with two diverse processes, neither of which can be omitted from the motive of a typical action, that both cannot perform the same function.

The resistance encountered by a nervous impulse in passing through a brain center for the first time, causes it to spread out into various undetermined, fortuitous directions. The result is a series of uncoordinated, purposeless movements motivated only by feeling, and constituting emotional expression, rather than voluntary acts. However, these primary, uncoordinated, purpose-

less movements are necessary to the development of the voluntary actions, since it is by means of such impulses that the brain centers become organized and cerebral transmission paths are marked out. These uncoördinated movements are a necessary preliminary to any conscious, voluntary act.

In general, these expressive, purposeless acts, motivated by feeling alone, are useless and unserviceable. But some of them are or may be advantageous, and are preserved by natural selection, or by that particular form of it which, in this case, has been called functional selection. The nervous organization that renders them ultimately inevitable is transmitted by heredity. It is in this way that we may account for the origin of those emotional expressions that we have recognized as beneficial to the individual and to the race.

An idea, in the proper sense of the word, is the concomitant of a centrally initiated impulse. The centrally initiated impulse is always weaker than one that is peripherally initiated, and the idea is fainter than the percept. No idea can be experienced that is not the concomitant of an impulse passing through a brain center that has been traversed before. No idea of an act can be experienced before the act itself has been performed. Before the idea of an act can be entertained so as to constitute a motive, the act itself must have been previously accomplished. The first time that any action is performed, it is done without the antecedent, motivating idea, and has the form merely of an emotional expression.

The above conclusions, which seem to be supported by reliable observations, put some serious limitations upon the possible actions, and upon the interpretation of their origin that have been made. If the preceding statements are true, as they seem to be, every action must originate in feeling, and, upon its first appearance, must be motivated by it. No idea can originate an action entirely new.

It is impossible for a wholly new action to be willed by that hypothetical entity called mind. The will is helpless in such a situation, and no psychologist who believes in the all-sufficiency of the will is able in the least degree to account for the failure of the will to lead to an action that is wholly new. The will is utterly unable to originate a new action or to organize a new brain center. Even the speech center is organized, not by will, but by means of impulses originating in sense organs and overflowing into it, running out into expressive movements, of which ultimately the useful are selected and the useless are finally eliminated.

The organization of the brain center is accomplished by means of impulses transmitted through it. The idea of an action is obtained from the action itself. The association of sensation centers and motor centers becomes closer and more definite by a repetition of the actions. The principal sensation centers involved in the idea of an action are the sight centers and the muscular sensation centers, although others are included. When the organization of these cerebral centers has been carried to such an extent that a centrally initiated impulse will be transmitted through these particular combinations that have been traversed before as a result of the perception of the action, then an idea of the action will be properly experienced.

Whenever the organization of the action centers, including both motor and sensation centers, has reached the condition in which a centrally initiated impulse can traverse the sensation centers and result in a clear idea of the action, an impulse is already traversing the combination of which the motor cells constitute a part. Hence it is that the idea of an action is the beginning of the action itself, and that any clear idea will work itself out into action, unless it is positively inhibited.

A nervous impulse is directed by means of the resist-

ance it encounters, and the brain centers which it traverses is determined by the degree of resistance that it meets. There is no other possible way by which its course can be decided. The nervous impulse will follow the path of least resistance as inevitably as water flows down hill. But resistance is the concomitant of feeling, and this fact furnishes us the solution of the most puzzling problem in all psychology. The action follows the idea, but feeling is that element which exercises a selective function, and determines whether one idea or another shall be entertained. A pleasurable action will be performed rather than a painful one, because the nervous impulse will encounter less resistance in passing into the center whose resistance accompanies a pleasurable feeling, than into a painful center.

The selective function of feeling is manifested throughout the whole range of muscular activity. The conscious voluntary actions following upon ideas, are those that have survived out of a very much larger series of fortuitous, erratic, purposeless, expressive actions. The survival of some forms of action in preference to others, is the result of a process of functional selection in which it appears that feeling, or its concomitant resistance, has been the principal factor. Functional selection is a process originating in feeling and its concomitant. Here, then, at the very source and origin of voluntary, conscious activity, we recognize the importance and all-determining character of the process which we call feeling.

Not merely in the origin of activity, but wherever conscious voluntary activity is manifested, we may discover the operation of feeling in its selective function. Feeling itself does not determine that an action shall be performed, but when a condition arises in which an action is bound to follow, feeling is the process that determines whether the following action shall be one or the other. The condition that makes an action inevitable is the con-

dition whose concomitant is an idea. Leaving aside all circumlocution that contributes to accuracy of expression, and seeking only definiteness, we may say that the idea is the driving force that leads to action, and feeling is the guiding, selecting agency, that determines that one action in preference to another shall be performed.

We thus see that every conscious, voluntary action includes in its motive both feeling and idea, and that the functions of both are different, but equally essential. Since feeling and idea vary independently of each other, we shall find the two elements entering into the motive in various and varying degrees. This does not prevent, however, our discovering the nature of the important function that each performs.

SYNOPSIS.

1—There are two theories of the nature of motive. One theory regards feeling as motive, and the other considers that all actions are motivated by the idea alone.

2—Facts are appealed to by advocates of each theory, and the arguments of one seem to demolish the arguments of the other.

3—We have assumed that feelings have been advantageous to the individual and to the species, and it is necessary to show how feeling has resulted in benefit to society as a whole.

4—A nervous impulse is always directed in its course by the resistance it encounters, and we have recognized resistance as the concomitant of feeling.

5—It appears, then, that the idea or its concomitant is the driving force, which determines that an action shall or shall not be performed, and that feeling is the concomitant of the selective function that determines whether one action or the other shall be performed.

6—Feeling and idea both appear in the motive, each exercising its function, and neither constituting the motive alone.

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